Canterbury Chamber of Commerce

AGRICULTURAL BULLETINS

Numbers 151-200

P.R. BLACK.
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ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

Farm Accounts: Preparation of Data for Tax Returns

Prepared by the Canterbury Agricultural College, Lincoln.

Bulletin CHRISTCHURCH, FEBRUARY, 1942. No. 151.

Most farmers will find it convenient to co-operate with qualified accountants in the annual task of completing Land and Income Tax Returns. By doing so they save themselves the bother of accountancy work which can be done more quickly by the trained man and they can also be more certain that all allowances to which they are entitled by law have been deducted. Generally speaking, only accountants are able to utilise the double-entry system of book-keeping which makes possible the preparation of a Farm Working Account and Balance-sheet on presentation of which the Tax Department will make an annual allowance for depreciation on such items as implements, plant, tractor, truck, car used for farming purposes, etc.

In the absence of a Farm Working Account and Balance-sheet, allowances for depreciation of items of the type referred to can only be claimed when they are sold or discarded. Unless special care is taken, the total amount of tax paid is, in the long run, likely to be more when allowances are claimed on sale or discard than when they are claimed annually under the double-entry system.

At this point it should, perhaps, be stated that depreciation on buildings may be claimed as an allowance annually whatever system of book-keeping is followed.

The following information is required for the preparation of Land and Income Tax Returns (the special tax form for farmers must be used):—

A. Personal Details:

1. Name in full, occupation, address and whether married or single.
2. Name in full of dependent wife and whether her income was over £50 or £200.
3. Names in full of dependent children under 18 years of age and dates of birth.
4. Names in full of other dependents and amount paid to house-keeper in case of widower, widow, or divorced person with dependent children.

If the Return is being prepared by an accountant, once the above information has been supplied, only alterations need be notified to him in succeeding years.

B. Details of Income and Expenditure during the Taxation year:

If a Return is being prepared by an accountant the simplest method for the farmer to adopt is:—

1. Pay all accounts by cheque and all receipts into the bank account, noting on the cheque or deposit slip all necessary particulars, and being careful to separate capital or improvement items from both private and personal items and ordinary farm income or expenditure items. It is chiefly these latter items that

are analysed and totalled under the various headings of the income tax form. The capital and improvement items are necessary if a full statement of assets and liabilities is to be drawn up each year and depreciation to be correctly deducted. The inclusion of the private and personal items enables the books to be completely balanced and the correct working out of the accounts proved.

2. Arrange with the bank for details of all cheques paid and deposits made to be entered in the bank pass book exactly as specified on the cheque or deposit slip, and for the accountant to have access to the pass book particulars.

3. At the end of the taxation year hand to the accountant a statement of numbers and value of stock on hand and quantities and values of produce on hand as well as details of any stock or produce which may have gone off the farm in respect of which payment had not been received. In the first year of co-operation with the accountant, the farmer must also hand in a copy of his previous year's tax return so that the stock and produce recorded on hand at the end of the previous year's returns may be entered on the tax form. The value of farm produce used in the private house for private, not hired hands' use, must be estimated, as must also the cash cost of keep of employees provided by the farmer. If estimated, this latter item is to be calculated at 15/- per man per week in the case of permanent hands. The proportion of car expenses to be charged against the running of the farm must also be recorded.

4. Hand to the accountant the Social Security Coupon Book so that the necessary declaration can be made.

C. Details of Freehold or Leasehold land held:

These should include area and legal description, etc., of the land and also amounts owing by way of mortgage or other registered charge, etc.

The foregoing comprises the minimum data required by the accountant and involves the minimum of labour by the farmer.

In order to provide a check on the data supplied as above and also to enable the preparation of fuller double-entry accounts, the following may also be supplied to the accountant:—

1. Details of amounts owing to or by the farmer at the end of the year. When the assistance of an accountant is first obtained, a statement of amounts owing at the commencement of the year is also necessary, as is a list showing the value of plant, implements and vehicles owned at the beginning of the year.

2. Details of petty cash expenditure not shown on cheque butts. These could be recorded in a small petty cash book or diary.

3. All the sales dockets, credit notes, bank deposit receipts, etc., received during the year. These should be filed as they come to hand and at the end of the year complete details of farm income will thus be readily available.

4. All receipts for expenditure during the year. These should be attached to the accounts and invoices to which they refer and filed in order.

If the bank account is to be balanced and complete double entry accounts kept, then all items of expenditure and income must be recorded. In particular, improvements, mortgage repayments, private investment and private expenditure items must be recorded, even though some of these are not

directly entered on the income tax form.

The Accounts and Balance-sheet which the accountant can prepare from the foregoing are valuable not only in the preparation of Tax Returns and in comparing the results of one year with those of preceding years, but also in giving a clear indication of the financial standing of the farmer. This is particularly important in relation to the raising or adjusting of mortgages or other loans.

Methods of Keeping Own Accounts:

The farmer may prefer to keep his own accounts. He could then prepare his own Tax Returns or could hand his accounts to an accountant who would merely check them and then prepare the Return.

There are several methods of keeping accounts which can be adopted:—

1. Enter all details of the receipts and payments on the cheque butts; carry the balance forward from day to day by writing down balance in bank at date £.....
   Add the deposit made, with particulars £.....
   Deduct cheques paid with particulars or bank charge £.....
   Carry forward the balance in bank £.....
   Sundry petty cash receipts and payments can also be conveniently noted on the back of the cheque butt for later record purposes. This is probably the most convenient method and most cheque books have the butts ruled as shown.

or 2. Enter items on separate pages of an account book suitably indexed. The pages may be numbered and headed in accordance with the various headings used on the income tax form. In some cases one book is used for recording monies received and another book for recording monies paid. In other cases the one book may be used for recording both receipts and payments. Other information required such as stock and produce on hand at the end of the year, etc., can also be recorded in the books.

or 3. Enter all items in a columnar account book. A book of this kind has a number of columns on each page and each column should be headed to correspond with the headings on the Return Forms. Items of income and expenditure are entered in their particular columns as they occur and at the end of the year each column is totalled and the totals entered in the proper place on the Return Form.

For example, a dairy-farmer would have a column headed "Butterfat Sales." Monthly returns from the factory would be entered in this column as soon as received and at the end of the year the column would be added up. The total obtained would be the farmer's income from butterfat for the year. The gross total received should be entered here and the charges made for goods supplied entered in the appropriate farm payment columns.

or 4. As an alternative to No. 3 above, enter all items of income and expenditure on a large columnar sheet at the end of the year. The headings of the columns would correspond with the headings of the Return form and the necessary information would be obtained from cheque butts and bank deposit receipts. The totals of the columns would then give the income and expenditure under the separate headings for the year.

In conclusion it may be said that some accountancy knowledge is of great advantage to farmers. Even if their accounts are prepared by qualified men, they will be better interpreted by farmers with such

knowledge. It has been said that if more farmers understood that their operations called for accounts in the same way as any other enterprise, a great number of farming failures would be avoided. This was made particularly apparent during the period of mortgage adjustment legislation.

The farming courses offered by the Agricultural Colleges include instruction in farm book-keeping to a stage which enables students to prepare double entry accounts and Land and Income Tax Returns.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.

ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

RAM RADDLING FOR COMMERCIAL FLOCKS

Prepared by the Canterbury Agricultural College, Lincoln.

Bulletin CHRISTCHURCH, MARCH, 1942. No. 152.

The purpose of this bulletin is to direct the attention of sheep farmers to the practice of raddling rams during tupping as one worthy of more widespread adoption. It is not generally recognised that this practice, long established in stud flocks, has many practical advantages to offer the commercial sheep farmer whose sheep are kept under reasonably close supervision. Contrary to general opinion the method presents no difficulties to the vast majority of fat lamb and low country flocks.

Our interest in its possibilities has been quickened by the considerable losses of lambs experienced in flocks where ewes lambing during inclement weather cannot adequately be protected since lambing dates are not accurately known. A striking example of such losses can be quoted. A flock of 1,000 ewes on a Canterbury Plains farm due to lamb over a period of two months experienced a not-unusual southerly storm during the early stages of lambing. It was impossible to provide adequate lambing shelter for the whole flock. Consequently ewes about to lamb had to take their chance with others lambing at a later date. In one night alone, due to weather conditions, lambs representing 13 per cent of ewes died at or shortly after birth. Later losses during similar nights accounted for a further 11 per cent. The final lambing figure of 113 per cent thus would probably have been in the vicinity of 137 per cent but for these avoidable deaths.

Farmers are prone to accept such losses, which are not uncommon, as unavoidable. While this may be so under extensive hill country sheep farming conditions, it is certainly not so in the smaller flocks on the better country. On such farms losses from this cause can be reduced to a negligible figure by adopting the practice of ram raddling at tupping to permit groups of ewes due to lamb at successive periods being drafted out and being provided with adequate protection during the critical period.

Ram raddling, or "keeling," consists simply of raddling the brisket and front belly wool of the ram so that the rump wool of each ewe is raddle-marked during service. The raddle is applied to the ram either in the form of a dry powder, in which case it is rubbed thoroughly into the brisket and belly wool, or as a paste made of raddle powder and oil mixed to the consistency of cream and applied with a brush or flat board. Of the two methods the oil raddle gives the more reliable results, since it leaves a better defined and more permanent mark.

By the use of different raddle colours during successive periods of time ewes are automatically marked into "lambing groups." A convenient time for changing the raddle colour is every sixteen to seventeen days, the normal interval between heat periods in the ewe. This interval permits ewes returning to service being marked with the new

colour. This necessitates the use of the colours in such a sequence that those used later will effectively cover the earlier ones where ewes have returned to service. Since the raddle is transferred to the ewe at service it is necessary to raddle all rams frequently. The best guide as to the frequency of raddling is the clearness with which the ewes are being marked. Experience indicates that rams raddled twice weekly will generally mark clearly all the ewes they serve. Since rams freshly turned out attempt to serve ewes indiscriminately, it is advisable, though not necessary, to withhold raddling until the morning following the turning out of the rams. Rams raddled when turned out may have the majority of their ewes falsely raddled during the first twenty-four hours. Apart from this giving a false impression as to the rapid progress of tupping, and later disappointment at the apparent return of marked ewes, this is really no serious disadvantage. Ewes thus falsely marked will be again marked with their true colour when they come into season.

Procedure.

The detailed application of these general principles to a flock of 1,000 fat lamb producing ewes would be somewhat as follows:—

1. Since ewes are more conveniently and efficiently tupped under any system in small mobs the flock is divided into four mobs of 250 ewes.
2. Allowing the usual quota of 2 per cent rams, five rams are turned out with each mob of ewes. These are turned out unraddled in the evening.
3. The following morning each mob of ewes is rounded up, the rams caught, and raddled yellow. The use of this colour is continued as required for the next sixteen days.
4. On the seventeenth day the raddle colour is changed to blue. The application of this colour is continued similarly for seventeen days.
5. At the end of this second seventeen day period the colour is changed to red for a further seventeen days.
6. By this time the majority of the ewes will have been served. The mobs are now boxed and "tailing up" rams turned out raddled black. As with the initial rams these latter are not raddled until they have been with the ewes overnight. Raddling is continued for a further seventeen days.
7. In case the raddle marks do not persist until lambing time the ewes are gone through after the rams have been taken out, and dot marked with branding paint according to their raddle colour. This is conveniently done at crutching time, provided crutching is not delayed too long after the rams have been taken out.

Use of the Information

The information given by the raddle marking can be made use of in many ways. Ewes which have been marked successively with each colour, together with unmarked ewes, are suspect dry ewes. These can be drafted from the rest of the flock immediately—a procedure impossible under usual conditions—and disposed of as fats during the winter. By doing so, advantage can be taken of the high prices ruling during this period of the year. If retained they can be given store treatment, thus releasing more feed for the in-lamb ewes. A word of warning is necessary here. Though it is highly probable that ewes which have returned to service four times will not be in lamb, a small proportion of these may have held to the last service. Such ewes, together with those raddled black only, would in any case lamb very late and might profitably be treated as dry ewes. Similarly a small proportion of the unmarked ewes

may be in lamb, having been tupped successfully during the first twenty-four hours by the unraddled rams. These, however, being the earliest lambing ewes, will be easily distinguishable at crutching and should then be dot marked as members of the yellow raddle group.

Knowledge of approximate lambing dates enables the flock to be divided at an early date into two or more mobs to facilitate winter feeding and management. Over most of the South Island supplementary feeding of ewes is essential and while it is desirable to feed all ewes well all the time, there is generally a critical feed period in July—the mid-winter month—which affects most the ewes in advanced pregnancy. During this time the yellow-blue mob should be given preferential treatment. With the approach of lambing the yellow-blue mob can be further sub-divided and extra shepherding given where it is most needed, i.e., to the "close to lambing" yellow mob. With only a relatively small number of ewes known to be approaching lambing, and these in one mob, it is possible to provide adequate shelter and more constant attention. As it is definitely known that the blue, red and black raddled ewes will not lamb for some time, they can be grazed in the more distant fields or in less protected areas, and the shepherding required for their care reduced to a minimum. When the yellow group has been lambing for some ten to twelve days, the blue group can be drafted out and given the same close attention which has been bestowed upon the yellow group. Similarly, in their turn the red group and the black group will receive this attention.

It is at this stage that the small amount of extra work involved in raddling the rams during tupping is more than recompensed by the time and labour saved in shepherding the rest of the flock. This is quite apart from the major advantage of a lowered lamb mortality emphasised earlier resulting from the extra attention which is available for the group actually lambing.

The fact that the flock is divided into relatively small mobs of ewes lambing at successive intervals makes possible the provision and use of lambing facilities generally considered to be impracticable under New Zealand conditions. The sheltered side of a plantation can be fenced with netting and, within this fenced yard, hurdle pens provided. On stormy nights the lambing mob can be confined within the sheltered netting yard while the hurdle pens are available for ewes with weak lambs.

Summary

1. Ram raddling offers a practical method of reducing lambing losses by permitting greater control of the flock at lambing time.
2. It enables more efficient management of the flock during the winter in that early lambing ewes can receive preferential winter treatment.
3. It makes possible the early drafting and sale at the high price period of dry ewes.
4. It requires a little more attention to the flock during the tupping period but this is more than compensated by the easier task during lambing.

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ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

Poisonous Plants On The Farm

Prepared by the Canterbury Agricultural College, Lincoln.

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Losses of livestock may be to some extent connected with the existence in pastures, cultivated fields or gardens of plants which are poisonous in character. In addition many plants though not actually poisonous are looked upon as harmful, in that they cause taints in foodstuffs, milk, dairy products or the flesh of animals. The problems of poisoning resulting from ingestion of harmful plants are complicated by a number of factors. There may be differences in susceptibility of animals to poisoning and differences in the readiness with which stock avoid poisonous plants. Where normal feed is plentiful poisoning is rare, but when animals are in a semi-starved state or are poor in condition, poisoning may develop suddenly. The nature of the plants themselves is a factor. For instance, plants which are acrid to the taste or smell will be avoided. Some parts of a plant are more toxic than others; some lose their poisonous properties when dried in the form of hay, while others are strongly poisonous both in the dry and green state.

The purpose of this Bulletin is merely to describe to the farmer the nature of those poisonous plants he should avoid.

The Buttercups: Most of these plants are acrid in taste or smell and some are severely poisonous, the flowers being the most harmful parts. The young shoots and stems in the early spring and summer are much less harmful. The poisonous principle is volatile and buttercups therefore are rendered harmless by drying in the form of hay. Celery-leaved buttercup is one of the most noxious species and frequently causes cattle poisoning. The symptoms which develop when celery-leaved buttercup is eaten include burning pains, thirst, vomiting, convulsions and death through shock. The plant is an annual, growing 1-2 feet high and is common in all kinds of wet places. The leaves are smooth and divided into three irregular lobes. The flowers are small, ¼-inch in diameter and pale yellow in colour.

Wild Turnip: Wild turnip may be poisonous especially when in bloom or seed. The seeds are dangerous to livestock as they contain volatile oil of mustard which brings about inflammation of the digestive tract. In the young green stage the plants are harmless. A description of the plant should not be necessary.

St. John's Wort and Tutsan: St. John's Wort grows stiffly erect up to 2 feet high. The leaves, ½ inch long, placed opposite to each other and fastened direct to the stem with no stalk, are dotted with oil glands. The flowers 1 inch in diameter are bright yellow spotted with black and are carried in terminal clusters. Tutsan, a related plant, occurs widely in North Island hill country. The stems in this species are angled and the leaves are large, egg-shaped and 1-3 inches long. The fruit of Tutsan is a black berry, in St. John's Wort it is a dry capsule. St. John's Wort and Tutsan are undoubtedly poisonous plants although stock are likely to avoid them because of their bitter taste and resinous odour. These plants contain a substance which renders the exposed **unpigmented** areas of the body unduly sensitive

to the burning effects of the sun. The so-called eczema which develops is similar to that of Facial Eczema. Some influence is also exerted on the nervous system resulting in markedly increased excitability.

Tutu: Three species occur in New Zealand each of which contains the poisonous principle **tutin.** This is not dangerous in small quantities and horses in particular are able to eat the weed without ill effect. It is believed that stock are affected only by eating moderate quantities day by day during which time the poison accumulates, or by eating a large amount when hungry or unthrifty. Under such circumstances abortion, convulsions and dopiness develop in cattle and sheep. In small amounts animals seem to develop a tolerance to Tutu.

Hemlock: This plant often occurs on hill country. It is highly poisonous and has resulted in losses of farm stock and deaths among humans. It may grow 5 feet or more high and has a hollow smooth stem dotted with purplish spots. The leaves are large and deeply cut, slightly resembling those of carrot plants. Small white flowers are carried in umbrella-like bunches or "umbels." When bruised the plant omits an unpleasant mousy odour and in consequence it appears to be rarely touched by stock although cattle, horses, pigs and sheep have all been poisoned by it. The poison is in the leaves during early stages but at maturity of the plant it is transferred to the seeds. The underground root is also dangerous. The poison is largely dissipated when the plant is dried as hay.

Ragwort: A biennial or perennial 2-3 feet in height with deeply cut leaves and dense clusters of golden-yellow flower heads about 1 inch in diameter. Ragwort is distinctly poisonous to cattle though not so rapidly as to cause immediately apparent symptoms. The poison is cumulative—small quantities of the plant taken regularly leaving the poison in the system untill illness suddenly develops. In New Zealand, Ragwort is a cause of cirrhosis or hardening of the liver of cattle and sheep, leading to severe emaciation, especially in cattle. Milk produced on Ragwort infected pastures is discoloured greenish and has a most unpleasant smell. The weed is harmful even in a dry state.

Black Night Shade is a small branched annual or biennial 6in.-2ft. high. The leaves are oval and the plant bears clusters of small white flowers. The round berries are at first green and later turn black. The poison, solanin, is present in the berries, stem and leaves. In some plants the amount of toxic alkaloid in the fruit or leaves is exceedingly small but nevertheless cases of poisoning of sheep, cattle, pigs and poultry have been recorded. The plant is looked upon as being unsafe, for, in some seasons, the berries may be edible, while they are distinctly harmful in other seasons. A related species, Deadly Nightshade, is definitely poisonous, but is very rare in New Zealand.

Henbane, related to Nightshade, is an annual or biennial plant, covered with fine hairs and with an unpleasant odour. It grows 2ft. high with toothed oblong leaves. The flowers are funnel shaped, 1 inch across, dingy-yellow coloured with violet veins. All parts of henbane are poisonous and the harmful alkaloids are not destroyed by drying.

Thornapple is a coarsely growing plant, related to the Henbane and Nightshade and growing about 2ft. high with very large toothed shiny leaves. The flowers are 3 inches long, white and funnel-shaped. At maturity the flower is replaced by a green thorny capsule about the size of a green walnut. All parts of the plant, especially the seeds, are poisonous. Owing to its disagreeable odour and taste the thorn apple is not likely to be eaten by stock under normal circumstances.

Foxglove: This well known plant, requiring no description, is a source of the drug **digitalis** and is recognised as poisonous. The seed heads, especially, are harmful, and the poison persists in either the green or dried state.

Bracken, Hard and Water Fern: It has been shown that these ferns

in large amounts are poisonous to cattle only when ingested in very large quantities. Dry or green bracken has been known to cause "staggers" in horses and evidence suggests that these animals are more susceptible to poisoning. Cases have been recorded of injury to sheep and cattle when grazing among fern shoots in the curl stage, but this is unusual. Pigs of course thrive on fern country, the rootstocks especially being much sought after.

POISONOUS PLANTS OF ARABLE LAND:

Occasionally stock poisoning may occur when any of the following weeds of fallow ground, stubble fields, etc., are eaten in quantity by stock.

Scarlet Pimpernel is slightly poisonous but the weed rarely occurs in quantities likely to result in harmful effects.

Sorrel contains toxic oxalates and may cause trouble in the form of a type of fever in sheep. Affected sheep go down, are dull and ultimately become unconscious; muscular spasms also develop. They may remain in this condition for 24 hours or so before death. A full account of Sorrel poisoning and its treatment is provided in the Agricultural Bulletin No. 96.

Spurges: Several of the Spurges and milk weeds of stubble and cultivated ground, are acrid and purgative and in sufficient quantity may cause serious results. Other weeds which are unsafe include Oxalis, Yellow Rocket, Larkspur, Poppy, Dock.

POISONOUS CROP PLANTS:

Cases of poisoning following the use of lupins have been recorded. Alkaloids have been isolated but there is considerable variation in the toxicity of different species. There are varieties which are very low in Alkaloid content and therefore non-poisonous. Blue lupins are fed in all stages of growth in New Zealand and it seems that the variety of blue lupin grown here is capable of being fed to stock with safety under ordinary management conditions. In America and Europe, lupinosis characterised by depression, muscular paralysis, asphyxia and death is sometimes very widespread.

Stock losses are known to occur on Clover, second growth Rape, second growth Oats and on Mangel or Beet tops. Little evidence is available to indicate whether such losses are due to direct poisoning or rather to other causes associated with feeding management on such crops.

Cereals or grasses affected with the Ergot fungus disease are dangerous even when eaten in small quantities. The dark hard fungus fruiting bodies in the seed heads are diagnostic but it should be borne in mind that this phase of the disease is preceded by a stickiness of the seed head. Of the grasses, Paspalum, Tall Fescue, Ryegrass and Cocksfoot are most susceptible and may cause ergot poisoning if stock are grazed on them when the seed heads are developed. Abortion or gangrene of the limbs are extreme effects of ergot poisoning. Darnel, a grass very similar to Italian Ryegrass, is harmless until the seeds are formed but the latter are unquestionably poisonous.

In dealing with the subject of poisonous plants, it is appropriate to consider the problem of farm seeds which have been treated with poisonous dusts for the purpose of fungus disease control. Sometimes it is asked whether Agrosan or Ceresan dusted seed wheat can be used as poultry feed during times when there may be shortages of feed grains. It has been found that dust disinfected seed wheat may be fed to poultry, if there is absolutely no other feed grain available, so long as the following precautions are observed. Do not on any account feed the grain continuously but supply it only in the evening at a rate of no more than one third of a pound of grain per bird. Feeding this grain should be continued no longer than three months. At Canterbury Agricultural College young pigs have been fed on Ceresan treated barley at the rate of 4lbs. daily for a period of 5 weeks. The animals continued in excellent

condition and there was no evidence of poisoning. On the other hand there are several reports of horses being poisoned after eating dust disinfected oats.

It is possible of course to wash dust disinfected grain in quarter bag lots in running water. By agitating the grain throughout the washing process much of the undesirable dust can be removed.

POISONOUS GARDEN PLANTS:

Stock poisoning sometimes follows ingestion of the foliage of certain garden plants and shrubs. Yew clippings, especially old leaves, are very poisonous. The symptoms include vomiting, bloat, giddiness, asphyxia and death. In some cases poisoning effects have followed cattle feeding on macrocarpa and laburnum hedges. Pigs and sheep are able to eat acorns with impunity but young cattle are susceptible to acorn poisoning. Oak-leaf poisoning has also been recognised. The Spindle-berry shrub is poisonous in all parts, the berries particularly so. Other garden plants exhibiting evidence of stock poisoning qualities include privet, ivy cherry-laurel, rhododendron and rhubarb. Such garden plants are abnormal forms of animal diet utilised only when stock are starving or isolated from their proper food.

PLANTS MECHANICALLY INJURIOUS:

Apart from plants directly poisonous or which induce illness or affect milk quality etc., there are some which cause physical injury. Crimson and Strawberry Clover heads may be associated with hairballs in the stomach. Barley grass and Brome grass may produce similar effects. Others such as spear-grass, wild oats, Brome grass, the various "burr" weeds may cause injury to the mouth or skin.

PREVENTIVE MEASURES:

When any of these poisonous or harmful plants are present stock should be removed to unaffected areas if this is possible, until the affected areas are rendered safe by the removal of the harmful plants. Such eradication may involve cutting or topping to prevent seed production, burning, hand pulling or application of chemical weed killers. The principles involved in combating harmful plants and weeds must be considered elsewhere but, apart from eradication of dangerous plants themselves, the more serious effects can usually be avoided when livestock have access to a sufficient normal diet, thereby having no desire to eat exotic weed or scrub species of plants.

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CANTERBURY CHAMBER OF COMMERCE
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Lamb Fattening: Trials with Sweet Blue Lupins

Prepared by the Canterbury Agricultural College, Lincoln

Bulletin CHRISTCHURCH, MAY, 1942. No. 154.

There are many different kinds of lupins. Some are annuals and others are perennials. They can all grow well on poor soils, especially if these are light or sandy in nature. Lupins also tolerate acid conditions but do not flourish when soil acidity is due to poor drainage. They all belong to the leguminous family of plants and consequently are able to enrich the soil by adding nitrogen compounds derived from the air.

In agriculture the perennial types are of little or no importance. Until recent times the main use for annual lupins was for green manuring. For this purpose they were widely used in Europe where large areas of light sandy soils bordering the North Sea were built up in fertility by this means. Their use extended to the Eastern Counties of England and later they were introduced into Australia and New Zealand mainly for the green manuring of orchards and gardens.

In Europe and England they found only limited use as a forage plant for stock. The best results were obtained when the lupins were grown in a mixture with other crops such as turnips or rape. Their usefulness was limited by the fact that sheep did not eat them readily and were inclined to lose condition until, through hunger, they were forced to eat them. When this happened the stock developed an "acquired taste" and thereafter did well on the feed. An additional bad feature was that sheep fed freely on lupins were liable to develop a "staggery" condition and suffer from lupin poisoning. Although this was not often fatal, sheepmen were naturally not keen to use a foodstuff which was responsible for developing these symptoms. Under Canterbury farming conditions during recent years, the common blue or bitter lupin has gained in popularity as a forage crop for sheep. The disadvantages referred to have been experienced but these are offset by the amount of feed produced, the reliability of the crop, its freedom from disease and insect pests, and by its marked capacity to improve the fertility of the soil. Once sheep have developed a taste for lupins they eat them readily and thrive upon them and there is no doubt that on large areas of our medium and light country, and also on better soils, the use of lupins could be greatly extended and this would result in benefit to the stock and to the soil. The use of the common blue lupin was outlined in Bulletin 110, published September, 1938.

Although the initial set-back experienced when stock are first introduced to the bitter blue lupin is not a serious matter with mature sheep, it is with younger animals and especially with lambs which are being fattened. The effect can be reduced by bringing the stock onto a mixture of lupins and other feed rather than onto lupins alone, but even then the punishment to lambs is so severe that considerable delay is likely to be experienced before they are ready for the freezing works. For this reason the bitter blue lupin is not favoured for lamb feed.

The unpalatable and "poisonous" features of the bitter lupin are due to alkaloids in the plant. Efforts have therefore been made towards the breeding of strains which contain less of these substances. This has been done and to European workers we are indebted for the new sweet yellow and sweet blue lupins, which are now becoming available. Small supplies of both these varieties were obtained by the College and these were grown in trials for the past three seasons. The sweet yellow variety has now been discarded. Although stock eat

it readily and thrive upon it, under local conditions it is not a good enough grower to justify its use. The sweet blue variety has proved highly satisfactory as a feed plant and yields a much greater bulk of forage and seed.

In appearance the sweet blue lupin is almost identical with the bitter blue. Our experience is still limited but it appears that on soils which are in poor heart it does not yield quite so heavily. On soils where there is a reasonable standard of fertility the yield is almost or quite equal to that obtained from the bitter variety. Sheep or lambs eat it readily and we have had no cases of lupin poisoning.

The results obtained up to the present time indicate that the sweet variety will probably completely oust the bitter strain for general use but that its main advantage will be as a replacement of, or supplement to rape as a fattening crop for lambs. In Germany where sweet blue lupins were first developed, they are so highly regarded that a prohibition against the growing of bitter blue lupins after 1940 was to be put in force.

For the fattening of lambs rape has been our most important crop but owing to the increasing difficulties of getting a good crop it is by no means satisfactory. It is very susceptible to damage by aphis, diamond-back moth and to some extent by the white butterfly, while on some soils club-root is also troublesome. Heavy crops are not common and a few days' hot nor'-west wind will cause serious loss to the light crops which are now generally grown on Canterbury soils. The sweet lupin does not suffer from these disadvantages, and there is no doubt that it is also superior to rape as a fertility-restoring crop. In addition, it is capable of greater production and in this season's trials the areas in lupins carried 50 per cent more stock than those in rape.

In preliminary trials last year areas of each of the three varieties, bitter blue, sweet blue and sweet yellow were sown on medium light land of the College farm on September 24th, 1940. The land had been in green-feed oats following an oat crop in the previous season and was not in very good heart.

Feeding commenced on December 28 (13 weeks after sowing) at which time the bitter blues were in the full green pod stage and the plants 18 to 20 inches in height. The sweet blues were not quite so far advanced and their height was 18 inches. The yellow variety varied from 8 to 18 inches in height and the bulk of foliage was much less than with either of the blue varieties. The production from the bitter blues was slightly greater than from the sweet blues but these would be regarded as a good crop. The object of this trial was not to measure the production of crops and consequently no attempt was made to measure yields. However, the yield from the yellow variety was so markedly poorer than that of the other two that it was decided to drop this strain. This decision was also based upon the poor production of the yellow variety in the two preceding years when the small supply of seed originally available was being multiplied.

All three types of lupins were grazed from December 28th to January 20th by light-weight merino hoggets. These were the only stock available at the time and it is certain that the weight increases would have been much greater with crossbred or halfbred sheep.

The hoggets on the sweet yellow lupins gained 6.2lbs. in live-weight, those on the sweet blue 4lbs. and those on the bitter blue only 0.9lbs. All lots had more feed than they could eat. This trial had several undesirable features, but it served to confirm the general opinions previously arrived at, and at least indicated that best results were to be expected from the sweet blue variety.

During last season a further trial was carried out. Again the main purpose was not to measure the yield of the lupin crop but to get an indication of its feeding value. Sweet blue lupins were compared with rape.

An area of six acres of medium quality land was selected and divided into six equal plots. The area had grown a crop of wheat and a crop of oats in the two preceding years. Alternate plots were sown with sweet blue lupins and with certified giant rape. The three lupin plots were sown on October 7th at the rate of 1¾ bushels per acre in 7 inch drills. The rape plots were drilled on October 24th (17 days later) at the rate of 2¾lbs. per acre at the same spacing.

It was expected that the lupins would need about two weeks longer than would the rape to reach a suitable stage for feeding off. Actually the lupins were in the green-pod stage by the time the rape had

matured. It is likely that had both crops been sown at the same time the lupins would have been in a better stage for feeding, i.e., flowering would just have been completed. In future trials it is intended to sow both crops at the same time.

On January 22nd when the rape was ready, feeding-off commenced and was continued until February 19th by which time the rape was practically finished although there was some feed still available on the lupin areas. The stock used were good Corriedale wether lambs in store condition. Stocking was at the rate of 20 per acre on the rape plots and 30 per acre on the lupins. In all, 150 lambs were used. Each lamb was ear-tagged and weighed before going on the plots and again weighed four weeks later when the trial finished.

Scientific precautions were taken to ensure a fair distribution of the lambs to the six plots. When the results were subjected to statistical analysis by standard methods, they proved to be highly significant.

The 60 lambs put on the three rape areas had an average initial live weight of 71.52lbs. When they were removed this had increased to 81.27lbs.—an average increase of 9.76lbs. per head.

The 90 lambs grazed on an equal area of lupins started at 68.47lbs. and finished at 80.33lbs.—an average increase of 11.87lbs. per head or 2.11lbs. better than the rape lambs.

The total live-weight increase on the rape was therefore 585lbs. and on the lupins 1068lbs.

No deaths occurred on either treatment. When the lambs were removed from the trial area they were boxed together and drafted by a reliable lamb-buyer who picked a draft of 80 lambs. When the ear tag numbers were checked it was found that 48 of these were lupin-fed lambs and 32 were rape fed. The drafter, who had no means of knowing one lot of lambs from the other, selected exactly the same percentage of lambs from each treatment. At the freezing works all but two of the selected lambs were graded "prime," the two second quality carcases being from the rape treatment. The lambs not picked by the drafter were, with one exception, (a rape-fed lamb) all in forward condition, but unfortunately the trial had to be discontinued at this stage.

The rape was not a heavy crop but it could be classed as reasonably good and farmers will have an appreciation of its bulk from the fact that it carried 20 lambs per acre for four weeks. It was fed under good conditions and was not badly affected by strong drying winds or by insect pests, although these were present.

In making available the results of these experiments the College desires to stress the fact that it is unsafe to draw conclusions from the result of trials conducted in any particular season. For reasons which are often obscure, equally striking results may not be forthcoming in another year. At the same time it can fairly be pointed out that there were no abnormal conditions in evidence this season and it is highly probable that similar results will be forthcoming in the future.

It is considered that the fattening of weaned lambs is such an important and serious problem to the New Zealand farmer and that the standard rape crop used for the purpose is so uncertain that there is ample justification for releasing without delay the available information in respect to a possible alternative crop.

If circumstances enable the work to be done it is proposed to continue these trials next season Greater areas and increased numbers of lambs will be used and in addition to trying the sweet blue lupins in competition with rape it is intended to try both these against a mixture of the two. It is possible that such a mixture of rape and sweet lupins will have advantages over either constituent when used alone.

The lupin crop is not a difficult one to grow but it should not be drilled deeply. The seed should be just covered. Best results are obtained by drilling on a rolled surface and 1¾ to 2¾ bushels is a satisfactory seeding. If the seed is of poor germination, as it often is, the amount should be increased. If used as an ingredient in a mixture about 1 bushel to 1½ bushels per acre will be found to be enough.

The production of lupin seed is made difficult owing to the tendency for the pods to split open and shed their seed when the crop is mature. This results in a loss of seed if the crop is ripe or in the production of inferior seed if it is harvested at an immature stage before shedding becomes prevalent. However, the difficulty is not sufficiently serious to preclude the growing of the

crop, and seed shed on the ground will germinate and give good winter feed if the land is skim ploughed after a crop is harvested. Alternatively sheep may be used to graze the stubble and pick up the seed.

It is likely that the sweet blue lupin can be best used in association with other crops as recommended in our Bulletin 110 for the use of ordinary blue lupins.

The most important avenues are:

1. As a mixture with rape for lamb fattening.
2. With turnips for late autumn and winter feed.
3. With Italian ryegrass for winter and spring grazing.
4. With **early sown** oats for winter and spring grazing.
5 As a cover crop with early-autumn or spring sown pasture.

Unless the lupins can be sown in January or February the amount of feed they will produce prior to winter will be disappointing. For seed production they can be sown during March in most districts or spring sowings can be made during the months of September or October. If care is taken to avoid overgrazing it is possible to take a light seed crop after feeding off the foliage with lambs and most farmers will find this to be the cheapest method of providing their own seed.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.

ELLESMERE GUARDIAN PRINT

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

CROPPING SYSTEMS

Prepared by the Canterbury Agricultural College, Lincoln.

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The productivity of arable land depends mainly on the supply of organic matter or humus in the soil. Continuous production of exhaustive crops such as cereals hastens the breakdown of this humus and uses up its nitrogen and no amount of chemical fertilisers can replace this loss effectively. On the other hand some crops, notably the legumes, have the great virtue that they will build up the humus thereby replenishing the essential nitrogen and restoring the fertility. The art of farming on this class of land lies in the building up of the soil fertility to a very high level and in maintaining it by a judicious rotation of cash crops with high producing forage crops and pastures.

A well balanced rotation keeps the soil in good heart thus ensuring easy cultivation and consistently good crop yields even with reduced applications of fertilisers; it allows a diversification of crops to be grown with resultant easing of seasonal farm work and it aids in the control of insect pests, crops diseases and weeds.

Principles of Crop Rotation

There are three main principles in rotation:—

1. Climate and soil type determine the type of farming most suited to a locality and the practices most effective in maintaining fertility. Thus the heavy loams of Ellesmere are admirably suited to the growing of wheat, barley, peas and pastures; the silt loams over deep clay on the plains for wheat, oats, forage crops and pastures; and thin stony silt loams overlying shingle for early forage crops, light crops of oats and Subterranean clover or temporary pastures.
2. One crop affects the growth of the crop which follows it and this is usually most marked when one type of crop is grown for two or more successive seasons.

   The importance of each crop lies not only in the yield obtained but also in its effect on the rotation as a whole.
3. A soil can be kept in the best heart when forage, cereal and pasture crops are grown in this order and in recurring succession.

This rotation must not be regarded as being fixed. Bad weather, prevalence of weeds and other factors make constant changes in the rotation necessary. It is an ideal which should be kept in view when adjustments are made in the planned programme.

A rotation must be sufficiently flexible to allow the introduction of catch crops should conditions prevent the sowing of the regular crop. Thus peas, barley or spring wheat may take the place of the regular cereal crop should the latter not be sown in autumn. A place must be made too for special crops such as peas and linseed which are well suited to certain districts.

Place of Forage Crops in the Rotation:

These crops have an essential place on arable land as supplementary feed supplies for the fattening and wintering of stock. The greater the bulk of leafy material produced, the more valuable the crop hence the forage crops are usually grown

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after grass when the soil is richest in humus.

In addition to providing essential feed, the forage crops may be regarded as cleaning or preparatory crops for the cereals which generally follow them in the rotation. Whether sown in spring or in summer their planting is usually preceded by a period of fallow during which time the soil is sweetened by cultivation and weeds are killed.

Furthermore, the forage crop improves the soil as the feeding by stock leads to a considerable addition of readily decomposable humus in dung and urine. This stimulates the organisms in the soil to greater activity and leads to a valuable increase in fertility.

Place of Cereals in the Rotation:

Cereals as a group are regarded as being the most depletive of all crops as they are heavy feeders of nitrogen and leave the land in need of recuperation. The more fertile the soil the shorter the period necessary for regaining its productivity, and, accordingly, it is good farming to put the land into restorative crops while it is still capable of producing another good crop of wheat. The taking of several successive "white straw" crops even from strong paddocks will damage the tilth and lower the fertility to such an extent that succeeding crops or pasture will make indifferent growth.

A rotation should be so designed that the cereal crop is sown when the soil is in good heart and a restorative crop should follow. This is even more strongly the case at the present time for whereas the wheat stubble was formerly ploughed under, now, with the increased use of header harvesters followed by the burning of the straw, there is not even this small source of organic matter. Farmers on clean land are advised to plough under the straw from headed crops. On land badly infested with such weeds as Wild oats or Wild turnips, the advantages of burning the straw outweigh other considerations.

Barley and oats are both easier on the land than is wheat and if a second cereal crop is grown in the rotation one of these crops is to be preferred on all but the most fertile paddocks.

Place of Special Crops in the Rotation:

The farmer must work with nature and conditions are not always suitable for the smooth continuation of a planned rotation. For this reason and to promote diversification it is always desirable to have an alternative crop in mind for each paddock included in the rotation system. These crops may be simply catch crops where a spring sown cereal may replace an autumn sown one, or a forage crop or peas may be advanced a year to take the place of a spring cereal which cannot be sown. These are adjustments within the range of crops normally grown.

In addition to such crops there may be special crops included because of their suitability to the class of land, or for fertility maintenance. In this category may be included the harvested crops such as potatoes, peas and lupins and green manure crops.

Potatoes:

On soils suitable for their production, potatoes, though gross feeders, are even more effective than the forage crops in cleaning the land and improving the tilth. The long preparatory fallow, the extensive cultivation before and after planting, and the heavy manuring given the crop are all reflected in improved conditions for the succeeding crop.

Peas and Lupins for Seed:

Both of these crops are now included in the cropping programme adopted by many farmers—peas on the medium and heavy land and lupins on the medium and light land. As leguminous crops they are soil improvers though this effect is less marked when they are saved for seed than when they are used for feed or for green manuring. Furthermore, peas as a spring sown crop and lupins as a spring or late summer sown crop also aid the spread of work.

Green Manure Crops:

Many farmers have increased the length of the cropping period in the rotation by including a green manure crop after a cereal crop and then following this with a

second crop. Blue lupins have proven to be admirably suited for this purpose and at the present time when fertilisers are in short supply and cereals are required, the use of lupins should be rapidly extended.

In many instances it would be more profitable to plough under as green manure, rape and greenfeed in excess of that required by the normal complement of sheep carried than to purchase highly priced store stock to consume the feed. Surplus feed thus added to the soil will continue to pay a sound dividend for several years.

Place of Pastures in the Rotation:

The most important means of restoring soil fertility is by means of dense and vigorous pastures. These will develop a deep bulky turf which when ploughed under produces an abundance of humus. The better the pasture the greater its restorative power or, as Arthur Young put it in 1770, "Wheat is ever the best after the best crops of clover."

The procedure necessary for the establishment of first-class pastures has already been covered fully in bulletin 79 and it is only necessary to repeat the important points.

1. Thorough fallowing and cultivation to produce a clean firm weed free seed bed.
2. Sowing in summer or early autumn using certified grasses and clovers.
3. Application of adequate lime and fertiliser to stimulate strong initial growth.

Pastures are more effective in building up the fertility when they are grazed exclusively but it is worthy of note that even pastures which are saved for seed are effective in improving the productivity of the soil. This being the case, it is possible to regard the pasture not only as a restorative crop to be used for stock feed, but also as a cash crop from which may be harvested ryegrass or clover seed, both readily marketable sidelines.

Cropping and Weeds:

The cropping programme is often influenced by certain weeds, particularly the flush of spring and summer annuals. Fathen, Shepherd's Purse, Wire weed, Spurry, Cornbine and several others germinate readily when the land warms up in the spring and sowing before this period often allows the crop to get well established before the weeds germinate. These weeds are also less plentiful in the first crop after grass than in crops sown later in the rotation. Autumn sown crops are usually less affected by annual weeds and when present they may be reduced by spring harrowing. When late spring or summer sown crops are established on land infested with annual weeds several harrowings during the later stages of seed bed preparation will help to reduce weed growth. Ridging of root crops and intercultivation is also an effective means of reducing weeds in such crops. Those weeds such as Spurry and Sorrel which thrive under sour soil conditions can be reduced by heavy liming.

Wild oats, wild turnips and wild tares, the seed of which persists in the ground for several years are a class of weeds of more concern in cereal crops and as they ripen their seed before the crop is harvested they increase rapidly under heavy cereal cropping. Areas heavily infested with such weeds may be cleaned to a considerable degree by adopting a system of fallow and forage cropping. As an example, in January, after wheat, plough 2 inches and harrow immediately; a month or so later plough 4 inches and harrow. Later in March sow greenfeed. In spring plough 6 inches and sow rape. After the rape, fallow again prior to sowing an autumn or spring crop. Such a system, extended, if necessary, encourages the germination of successive batches of weed seeds and prevents reseeding and is a practical method of reducing such annual weeds.

Perennial weeds such as Browntop, Creeping Fog, Onion-rooted Twitch and many others with the twitch habit are best controlled by establishing in pasture for three to five years. This causes most of the twitch roots to come to the surface two inches or so. When this state is reached, spring or summer fallowing can be more effectively car-

ried out in preparation for roots, greenfeed, or a cereal crop, or alternatively ridged crops, such as potatoes.

Wheat and Flax Production:

The present war time conditions requiring increased production of wheat and flax impose modifications of planned cropping programmes in order to extend the areas devoted to wheat and to linen flax. Increased acreages of these crops can be obtained by:—

1. Breaking up old pastures and using the increased acreage under cultivation to extend the area devoted to these crops. If the pastures have been skimmed over early in summer they may be used immediately for wheat. If ploughed in late autumn, or in winter, then they may be used for flax.
2. Delaying the sowing down of paddocks which are due for grassing, growing a restorative crop and following this with wheat.
3. Growing additional cash crops in spite of resultant reduced fertility.

In order to avoid undue soil exploitation, quick restorative crops should be alternated with the exhaustive crops and the long term pasture may be replaced by the short term pasture. In order to add humus and nitrogen to the soil the adoption of this system should be accompanied by an increase in the growing of lupins for feed or green manure during periods when the land would normally be under fallow.

In the place of "long term" pasture of perennial grasses and clovers which has a steady and progressive fertility restoring power, there must be an extension of vigorous high producing "two year" pasture of Italian ryegrass and red clover which has a greater fertility building power over a two-year period.

These "hurry" methods may not be as effective as the use of long term pasture in rebuilding the soil fertility after a period of exhaustive cropping but their use will enable a high production of essential crops such as wheat, barley, oats, peas and linen flax to be maintained on the same paddocks for several years without leading to serious fertility depletion.

Summary:

The art of cropping is the production of consistently good yields of clean seed while maintaining the soil in good heart. This can be done only by rotation of crops. While forage crops may be considered as important restorative and cleaning crops, the most valuable crop of all for this purpose is the clover-rich pasture. Indeed, it may truly be said that the maintenance of the productive capacity of the cropping land can be achieved only when grassland farming is carried on at a comparably high level.

Under present conditions when maximum crop production is required the regular rotations practised by many farmers must be modified. This can be done best by:—

1. Ploughing up and cropping land that has been under pasture for many years.
2. Increasing the use of the quick restoring crops such as lupins, peas, and forage crops as alternates to cereal crops.
3. Replacing long term permanent pastures with high producing pastures of Italian ryegrass and red clover.

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FLLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

The Establishment of Permanent Pasture in Canterbury

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Introduction

In Canterbury there is a wide diversity, not only of farm type but also of the management practised in utilising the land to best advantage. Climate and soil types combine to create this position, and in dealing with the subject of this bulletin, an appreciation of the farming situation as a whole is essential.

There are areas where practically no cultivation is carried on, the land being devoted entirely to grazing, e.g. the "back country" and Banks Peninsula; areas of limited cultivation such as the rolling downs of North Canterbury and areas where a large portion of the farm may be under the plough each year, as is the case on the plains where green feed and cereal cropping make up the greater part of the year's operations. Again there are limited areas of heavy fertile land where dairying is the main pursuit but where cropping of small areas may or may not be carried on. The clay downs of the foothills extending from Waiau in the North to the Waitaki River, in a more or less continuous chain, present a special problem in pasture establishment and management.

To cover this wide range of pastoral possibilities in detail would be beyond the scope of this bulletin so the work will be confined to the stating of fundamental principles with the interpolation of specific recommendations of importance to each class of farming.

Pasture Establishment

Four main principles govern the successful establishment of pastures.

(1) Soil fertility.
(2) Seed bed preparation.
(3) Class of seed sown.
(4) Time and method of sowing.

Soil Fertility: There are two aspects of this question which must be considered. The first and obvious one is that to ensure strong pasture growth the land should be in reasonably fertile state. This may be the result of naturally fertile soil conditions such as are found in our heavy land, or it may be necessary to fallow or grow a soil-improving crop, and apply fertilisers—superphosphate and lime at the time of sowing, in order to provide readily available plant food for the pasture plants in the early stages of the pasture's life. Draining of land is also an essential requirement for high fertility and in wet, waterlogged locations, tile or mole drainage should be carried out before a permanent pasture is laid down, if from a financial point of view it is practicable to do so.

The second aspect of soil fertility is one which is of special interest on cropping farms where the establishment of a 5-7 year pasture follows a cycle of cultivation and cereal cropping. The main purpose of the pasture is to provide suitable grazing for stock, but the additional function is to restore the fertility drawn from the soil during the cropping period. This is done thoroughly and efficiently only when a good dense turf is established, capable of carrying many stock so as to gain an accumulation of dung and urine and at the same time blanket the soil with a dense vigorous layer of grass roots and residues. To attain this end the grass seed should be sown on a seed bed which will encour-

age rapid, vigorous growth of grass and clover and the development of a dense sward in a short time.

Seed Bed Preparation

It must be appreciated that all cultivation prior to the sowing of permanent pasture should be aimed at the production of a well drained, weed free, fine, firm, seed bed. The achieving of this fundamentally desirable end, or of the degree of perfection possible on any farm depend on several factors; the nature of the soil, climatic conditions experienced during the months prior to sowing, the system of management followed on the particular farm, and the mechanical and financial resources of the farmer. All these combine to give rise to the wide range of methods found in Canterbury. Some of these methods give highly satisfactory results, others are reasonably successful, while others again work under a wide margin of uncertainty as to their final success.

Ideal methods are not always possible or even desirable in many cases, but too often short cuts are adopted which might well be discarded if there was a clear realisation of the vital importance of good pasturage on our farms—and particularly our cereal cropping farms. Too often grass is regarded as a "catch crop" designed to fill the gap between one series of crops and the next. Such an attitude leads to indifferent workmanship in the soil preparation preceding sowing and consequent poor pasturage as a result.

The following is a brief outline of the methods encountered in the province:—

(a) Spring sowing under a cereal, wheat or barley. The cereal crop is rolled and/or harrowed in September when the crop is about 3 inches high, the grass seed is broadcast without manure as a rule and allowed to come away under the growing crop.

(b) Autumn sowing after the harvesting of a cereal crop. The land is worked up rapidly after the crop comes off and the grass seed is sown with super.

(c) Spring sowing with a forage crop, such as rape. In this case the land is winter fallowed, worked down and both rape and grass are sown in October. Sowing with turnips is similarly attempted.

(d) Autumn sowing after rape. In this case the fed-off rape land is disced or grubbed to a depth of 2-3 inches, harrowed and rolled. The grass is broadcast, usually early in March.

(e) Sowing after fallow in spring, late summer or early autumn. The land is usually ploughed in late September, summer fallowed and sown at any time from New Year onwards, depending on the weather.

Method (a) is at the present time the most common on the wheat farms of Canterbury. At best it can be regarded as a cheap way of doing the job; it is not, however, a wholly successful method as the resulting pasture may be good, bad, or indifferent, depending on the weather experienced in the weeks immediately following the harvesting of the grain crop. As a rule in Canterbury, January and February are dry months, the young grass exposed in the stubble to the heat of summer wilts badly and unless adequate rain falls all the clover and a great deal of the grass dies, leaving a 50 per cent pasture or worse. On the average it would be safe to say that in only one year in five will this method give a worth-while high class pasture, except in districts where summer rainfall is normally experienced.

The same objections apply to method (b) as it is obvious that during a dry autumn the stubble may not be fit to work up until well into March or April. Grass sown then will be late striking and the loss of young seedling plants through frost-lift may be severe.

Spring sowing with rape or turnips (c) has for years been regarded as one of the safest methods of pasture establishment, and so it is, provided the farmer goes for a pasture with the cover crop as of secondary importance. If, however, the rape or turnip crop is too heavy, the young grass will tend to be smothered, and later on the heavy stocking necessary to deal with the crop may be responsible for the destruction of a large proportion of the grass and clover plants. With turnips too, winter

feeding in a wet year results in the land being badly poached and the grass again is thinned out.

The autumn sowing of rape land after the lambs have been fattened (d) has proved highly satisfactory in North Canterbury. The shallow working keeps the plant residues and dung near the surface and provided the grass receives a reasonable rain in early autumn, it will grow very fast and develop a good roothold before the winter sets in.

It is the last mentioned method of sowing, after fallow, which though it is not yet widely practised, has proved to be the most certain method of establishing a first class pasture. The summer fallow, even of three months' duration, renders the soil clean, fine and fertile so that the seed bed encourages rapid, certain germination of the seed.

The actual selection of the method of sowing is usually determined by the various conditions governing the management of the farm as a whole, and in practice there is most often a combination of all the methods outlined above. But while it is important to recognise the part which expediency plays in arable farming, it is important, too, to stress the fact that too often the apparently easy way to pasture establishment is in reality the most uneconomic, and is far too often resorted to because of lack of farsighted planning in the first place. Arable farming does not work on a year to year basis but rather must the scope of operations be considered over several years, covering what is commonly called the rotation cycle. When the rotation cycle involves the ploughing of old grass and the sowing down of new pasture, plans should be made to ensure that as much of the new grass as possible will be laid down in such a way as to ensure good pastures. And of all the methods available, sowing on stubble is the least satisfactory while sowing on fallow gives the best guarantee of success.

Class of Seed Sown

Two main points must be considered—(1) Seed Quality; (2) Species and Strain.

(1) Quality: Seed sown should be of known purity and germination. Although this would appear to be a self evident fact it is still far too common to find farmers accepting seed of inferior quality because of its so-called cheapness. Poor seed is never cheap—and there are no exceptions to this rule of good farm husbandry. If there is any doubt about a line of seed a certificate of purity and germination from the Seed Testing Station at Palmerston North should be demanded.

(2) Species and Strain: The species of grass sown should suit the requirements of the farm; consider the matter under the headings—rainfall, soil type, and utilisation. This latter item is just as important as the others; it is not good policy to overlook the fact that the saving of grass seed is a valuable source of return from our pastures, hence the necessity to avoid the mixing of species which will not allow of reasonably easy harvesting or which may, by their association, lower the quality of the resulting seed crop, e.g., Italian rye with Cert. Perennial rye.

Of each selected species the most desirable strain should be sought. The Government Certified grasses and clovers are available in the following grades:—Government Stock; Pedigree; Mother Seed; Permanent Pasture. Where there is a possibility of subsequent seed crops being harvested, Stock or Pedigree grades should be sown, but for normal grazing requirements Mother or Permanent pasture grades are cheaper and almost equally good.

Grass Seed Mixtures for Permanent Pastures

There is a wide margin of selection as to the mixing of species for permanent pastures. The following may be taken as guides for general purposes.

North Canterbury Seaward Downs—	
Perennial Ryegrass	25 lbs.
x Crested dogstail	3 lbs.
White clover	2 lbs.
Broad red clover	3 lbs.
Subterranean clover	3 lbs.
Plains "Wheat" land—	
Perennial Rye	25-30 lbs.
White clover	2- 3 lbs.
xx Red clover	4 lbs.

Heavy dairying land—

Perennial Ryegrass	15 lbs.
Cocksfoot	12 lbs.
x Timothy	4 lbs.
Montgomery red clover	4 lbs.
White clover	2 lbs.

South Canterbury Downlands—

Perennial Rye	25 lbs.
x Crested dogstail	3 lbs.
Montgomery red clover	4 lbs.
White clover	2 lbs.

Foothills—"Brown top" country—

Perennial Rye	30 lbs.
x Crested dogstail	3 lbs.
Montgomery red clover	4 lbs.
White clover	2 lbs.

Better class "shingle" country—

Perennial Rye	10 lbs.
Cocksfoot	12 lbs.
White clover	2 lbs.
Red clover	3 lbs.
Subterranean clover	2 lbs.

Light Shingle Country—

Perennial Rye	8 lbs.
Cocksfoot	6 lbs.
Subterranean clover	5 lbs.

x Optional.
xx Omit red clover if white clover seed saving is a regular farm activity.

Time and Method of Sowing

Grass seed may be sown under our varying soil and climatic conditions in the spring, in late summer and in early autumn. Spring sowing is suitable on the plains where the land is not liable to excessive drying out in mid-summer or where summer rainfall is fairly certain, as in the foothill area. Late summer and early autumn sowings, particularly on fallowed land, are usually successful. Late autumn sowing is risky as early frosts can cause a high death rate amongst the young seedlings—particularly the clovers.

Method of Sowing:

On medium and good soils broadcasting on a rolled surface is the most satisfactory method for grass seed and if heavy harrows are not used it serves for clover seed also. The latter seed must not be buried deeply and should be covered by either a second rolling or by the use of a light covering harrow. On light and less fertile soils more certain establishment may be obtained by shallow drilling of the grass and clover seeds. As this method leaves the plants in rows and results in bare spaces in the turf, a compromise method may be adopted so that the seed falls from the grain outlets of the drill—part of the seed going through the coulters while part falls directly to the ground.

The mixing of the seed with the manure is commonly done and has no ill effects on our main pasture species. With subterranean clover it is recommended that the seed be drilled with reverted superphosphate or a mixture of lime and phosphate in the early autumn. The drilling should be shallow—on a rolled firm seed bed.

Liming

There is ample evidence that the application of lime contributes greatly to the success of pasture establishment in Canterbury. Dressings may vary from half a ton per acre on the lighter plains land, 1 ton per acre on the medium clay soils to 2 tons per acre on the heavy clay "Brown top" country.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.

ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE

AGRICULTURAL BULLETIN

Management of Permanent Pastures in Canterbury

Prepared by the Canterbury Agricultural College, Lincoln.

Bulletin CHRISTCHURCH, AUGUST, 1942. No. 157.

The preceding bulletin was devoted to the question of pasture establishment. This bulletin discusses the maintenance and management of permanent pastures in Canterbury after establishment.

1. Newly sown pastures: The early treatment of pastures sown in autumn should follow certain well defined lines. Grazing of young autumn pasture should be regulated to achieve the following ends:—

(a) Weed control.
(b) Encouragement of tillering in the grass species and development of the clovers.
(c) Consolidation of the land and hoofing in of the young plants so as to minimise the effects of winter frosts.
(d) Avoidance of excessively heavy grazing which may weaken the sward before the plants have a chance to become established.

All these conditions are fulfilled if judgment is employed in the handling of the stock, particularly sheep. Let the grass get away to a height of two or three inches; then run in a mob at the rate of 20 or more per acre and graze off quickly; run them off again and give the grass time to recover before repeating the performance. With one or two good grazings by the end of May the chances are that the pasture will be available for heavy grazing by lambing ewes in late August and September.

Where the grass has been sown with a cereal crop in the spring, special care is required in the weeks immediately following the removal of the crop. It is normal practice for our stubbles to provide grazing for ewes with or without lambs. If the season is favourable, reasonable stocking will not damage the young grass unduly, but the over-grazing which is so often necessary in a dry autumn may be responsible for thinning out both the clover and the grass. Unfortunately in Canterbury where this method of sowing pasture is carried on, those seasons which do not favour the strong growth of the young grass are usually those where the shortage of feed compels the farmer to overstock the already weakened pasture. Hence the number of failures which result from this very convenient but somewhat unreliable method. It is a gamble, but the odds might be shortened if very light autumn stocking were practised in the years of adverse climatic conditions.

Where ryegrass is the dominant species in a young pasture it is remarkable how rough the early treatment may be without any fatal results. But where the aim is a mixed sward, with cocksfoot in association with ryegrass, overgrazing and badly timed grazing are responsible for most of the disappointing results so frequently reported. Cocksfoot is an expensive seed, and much of it is sown, never to be seen again. Two factors contribute to this; one is the faulty blending of the seed mixture (too much ryegrass, too little cocksfoot) and the other is failure to appreciate the fact that the type of grazing which suits perennial rye does not suit cocksfoot. The rule governing the establishment of cocksfoot should be—graze the young pasture carefully to give the slower growing cocksfoot a chance to become established. If this care cannot be guaranteed, save the cost of the seed and sow ryegrass alone.

Well Established Pastures: The successful maintenance of permanent pastures depends on adequate topdressing with phosphates and lime with the avoidance of overgrazing. Where both these conditions are fulfilled the grass and clover species maintain their as-

cendancy over the less productive weeds and weed grasses. These are always present. When the fertility falls below the standard required by the better grasses and clovers, or when unduly heavy grazing is practised, these weeds come into prominence.

However long the pasture has been down the grass requires periodic spelling. This is well exemplified in the hill pastures of Banks Peninsula where sustained grazing, particularly with sheep, results in the thinning out of the cocksfoot to such an extent that in many of the bays it has been replaced with poorer grasses, danthonia, fog, bromes, etc. If taken in time and given a year of grazing by cattle alone the cocksfoot may be rapidly regenerated. Unless control of grazing is systematically carried out the cattle carrying capacity of the Peninsula will ultimately be seriously reduced, and this in turn will lead to a general deterioration of the hill pasturage.

Stocking of Permanent Pastures: This brings us to the further consideration of the question of pasture stocking. On the mixed farm the type of stock kept is normally limited to breeding ewes, with or without hoggets for flock replacement. One of the main problems on such farms is the provision of adequate grazing at lambing time and during the period of lamb fattening when the greatest percentage possible "off the mothers" is aimed at. The greater the number of milk lambs, the less the need for supplementary fattening crops. Pasture management, therefore, should be along lines which will give the grass ample opportunity to provide maximum feed at the period mentioned above. The chief means of doing this is to confine the winter grazing to those paddocks which are used either as a "run-off" from the green feed or root crops, or as areas on which hay or chaff are fed. Other paddocks should be left unstocked. This gives the grass a chance to build up its root system and "crown" for a quick getaway in the early spring. It is important to remember that during the time that the paddocks are unstocked there is no appreciable hardship to the ewes as the limited amount of picking they would obtain would make little difference to their diet provided the supplementary feeding is adequate. On the other hand, if the grass is close grazed, the constant nibbling so lowers the vitality of the plants that rapid spring recovery is impossible. Winter spelling of lambing pastures should be one of the main considerations in Canterbury pasture management. During lambing the practice of drafting the lambed ewes onto the better grass paddocks as the green feed runs out can be followed until the number in each paddock is reached for set grazing, and thereafter in normal seasons the pastures can take care of themselves.

Where seed harvesting is desired, heavy winter grazing suits paddocks intended for white clover seed, while light winter grazing is best where ryegrass seed is to be harvested. Heavy stocking of the stubble from which a crop of grass hay (or seed) has been taken should be avoided until the plants, which have been devoting their energy to stem and seed production, have a chance to tiller out again and are once more able to stand up to grazing.

Foothill Pastures: Management of pastures on this class of country should be concerned chiefly with the maintenance of the lime and phosphate content of the soil and the constant exclusion of browntop by the preservation of a dense vigorous sward of ryegrass and white clover. This result can be attained by sowing permanent pasture strains on a thoroughly well prepared seed bed, by top-dressing regularly with lime and superphosphate, and by the avoidance of overstocking, particularly in the winter and early spring. This is most important for once heavy and ill-judged grazing has thinned out the sward the ever-ready browntop will begin its insidious invasion.

The development of pasture management and grass farming technique on the foothill country is still limited, but there seems no reason why the handling of this type of country on the lines indicated should not be attended with the same success as has been achieved under comparable conditions in Southland.

Downland Pastures: On the drier downlands such as are found in North and South Canterbury, the main problem associated with the maintenance of permanent pasture is the holding of the clover component of the sward. In such country, stands of Montgomery red and/or subterranean clover are more likely than is white clover to survive. Montgomery red clover has the advantage of being a deep rooter and so can survive the drought

period, while subterranean carries over the summer by means of its seed. Topdressing with lime and superphosphate will assure their performance provided that in the case of subterranean the grazing in its first year has been light enough to allow of a good setting of seed. Once this initial seed setting has been effected the nursing of the pasture for the sake of the clover is no longer necessary. One of the best methods of bringing this about is to save the paddock for hay or grass seed in the first year, or to graze it with cattle during November and December of that year.

Light Plains Pastures: The light soils of the plains are naturally lacking in fertility,, are subject to severe summer drought, are open textured, and subject to frost lift in winter. Grass grub is a frequent and devastating visitor. At the present time several methods of pasture management are followed. Where the stock graze mainly on the "natural" herbage—danthonia, sweet vernal and browntop, together with suckling, clustered, knotted clovers the haresfoot trefoil, stocking is light, and no topdressing is carried out. Winter feeding is by means of turnips, green feed and oaten chaff, and some new grass is sown each year.

On some holdings regular renewal of short duration pastures every three or four years is carried out, with similar winter feed provision. With diesel tractors and large implements cultivation can be done relatively cheaply. Under this system 30 per cent of the farm may be under the plough annually and the carrying capacity may be comparatively high. Paddocks may be topdressed for one or two seasons. Another method is to carry the stock on topdressed subterranean clover pastures with the use of lucerne hay or subterranean clover hay and a limited area of green feed and roots for wintering.

Under all these methods there is need of the supplementary feed for at least three months (and it may be for four months) in winter, while there is the ever-present possibility of the pastures drying off in the early summer should a series of severe nor'westers occur in November. Such dry conditions may, and often do, prevail until March and April so that the autumn growth is delayed and the perennial species die out. Subsequent rains lead to the germination of the annual grasses and clovers, but these may perish through frost lift. Spring growth is then limited mainly to browntop, danthonia and hairgrass.

The vital problem of these pastures is to establish pasture species which are capable of persisting under such adverse conditions, and at the moment subterranean clover is the most promising. From observations to date it appears that this plant, given the opportunity to set seed freely in the first year (e.g. underseeding a crop of oats) will set sufficient seed to carry it on indefinitely. Once the seed is in the ground it will re-establish itself each year to give a good spring growth, particularly if it has been topdressed and has not been too heavily grazed during the winter. Provided the onset of the summer dry period does not occur before the beginning of December a fairly high percentage of the lambs may be fattened off the mothers, but there is still need for a fattening crop to top off the remainder.

It has been demonstrated that with reasonable clover content in the pasture, light land will respond markedly to the application of lime and super in conjunction. The response to super alone is often most disappointing and there is clear evidence that for good results the two should be used in conjunction. Five cwt. of lime and one cwt. super should be the initial application, and after this five cwt. of lime and one cwt. super in alternate years will maintain the subterranean clover pasture.

Pastures for Dairying: While the area devoted to dairying in Canterbury is limited there are certain districts where the soil type favours the growth of heavy, highly productive swards. The principal species are perennial rye and white clover, but in many of the older paddocks, cocksfoot, timothy and meadow foxtail are common, while in some areas strawberry clover contributes materially to the density of the turf.

In order to obtain maximum production on these dairying lands, newly sown paddocks should be seeded with a mixture containing perennial rye, cocksfoot, white clover and Montgomery red clover. Other grasses such as timothy and foxtail might be added with advantage on the wetter areas. Early autumn sowing on a fallowed seed bed and light grazing of the young sward, will result in a well balanced permanent pasture. As with pastures

for lambing ewes, the secret of spring grass lies in the light winter stocking of a portion of the farm from about May onwards. Where the land is low-lying, and inclined to lie very wet in winter and well into the spring, some system of drainage is essential. Tile draining, while highly effective, is as a rule too costly, but mole draining, provided the soil is not a sandy-silt, gives good drainage at a fairly low cost. The removal of excess water contributes as much to the productivity of these paddocks as do liming and topdressing. Grazing is prolonged in the autumn and spring feed is earlier.

In the case of the farmer engaged in town milk supply the carrying of cows on water-logged pastures in winter makes it difficult to maintain the supply. Draining of the land will improve the position, but in recent times some town suppliers house the milking cows for the worst three months of winter. This practice has a markedly beneficial effect on the pastures which are practically unstocked for this period and respond to the spelling by coming into the spring in good heart.

At the end of summer, dairy pastures should be well harrowed to scatter the dung. Liming every few years at the rate of not less than 1 ton per acre is essential and the application of 2 or 3 cwt. of super per acre annually is the normal requirement of such pastures. The stocking of these dairy farms should be such that the normal hay requirements of the herd can be cut from the grassland each year. For preference the same paddocks should not be saved for hay each year as this tends to weaken the white clover content of the sward. Haying also encourages the taller growing grasses, cocksfoot and timothy.

Summary of main points in bulletins on Pasture Establishment and Pasture Management.

Pastures should be sown in spring, summer or early autumn on well prepared, well drained, limed land. Sowing on fallow produces the most satisfactory pastures.

Seed of high quality should be sown — with special preference to certified strains of grasses and clovers.

Grazing should be carefully regulated in the early stages. Where cocksfoot or timothy are desired ryegrass seedings should be reduced.

Annual topdressing with superphosphate is essential and liming at regular intervals should be practised. The quantity of lime required in the initial stages depends on the soil type but it should be adequate to promote and encourage rapid clover development. This is especially the case on the clay downs of the foothill country.

Systematic spelling of pastures in the winter is the key to abundant grass growth in spring and early summer. Overstocking of pastures is one of the principal causes of the sward breaking down and reverting to inferior species.

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ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

Barley Growing in New Zealand

Prepared by the Canterbury Agricultural College, Lincoln.

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In New Zealand malting barley is an important crop in those districts which have been proved by experience to be suitable for its production. Following the introduction of a protected market, a minimum price schedule and grading standards, the acreage has risen from between 20 and 25 thousand acres a few years ago, to 45 thousand acres in 1942.

New Zealand is now self supporting as far as the production of malting barley is concerned but there is still need to import large quantities of feed barley for the pig industry. In the South Island barley rejected for malting is used for pig feed and any surplus is sold to the North Island, but the main supply of feed barley for the North Island farmers is imported. Barley is also used to some extent as a green feed for both cows and sheep. It is one of the quickest growing of the green feed crops and can be used with advantage to forestall an anticipated shortage of forage. The Cape and Black Skinless varieties are to be preferred for this purpose and will provide grazing within six weeks of sowing under good soil conditions. These two varieties are also good feed barleys.

This bulletin deals more particularly with the production of barley for malting for which purpose a high standard of quality is required. After stating the characteristics of a good malting barley the process of malting is outlined, the need for high quality is stressed and the methods by which this high quality can be attained are discussed.

Quality in Malting Barley

Barley to be accepted as suitable for malting must be dry, plump, bright, sound, clean and free from other seeds. Certain standards to meet these requirements have been set up and agreed upon. For top grade No. 1 malting barley they are as follows (after passing over a 6a screen)—

		%
Flinty grain	under	10
Foreign matter	under	.5
Wild Oats	under	.5
Skinned and broken grain	under	2.0
Tares and round seeds	under	5.0
Sprouted grain	Nil	
Moisture	under	15
Bushel weight	52lbs.	
Disease	Trace	

There are four grades of malting barley with decreasing minimum prices for decreasing set standards. If a line fails to reach the standard of Grade 4 it may be rejected for malting and can be sold only as feed barley at a much lower price. Appeals against the grading can be made through the Department of Agriculture on the advance of a fee of 10/-.

The Malting Process

Over 800,000 bushels of barley are required each year for conversion into malt, which is used for the manufacture of ales, beer and other alcoholic beverages as well as for yeast, malt extract, malted milk and vinegar. Barley is more suitable than other cereals for this purpose as it contains a high percentage of starch and a low percentage of undesirable nitrogenous substances and the kernel is enclosed in a fibrous coat which aids in filtering the soluble extract. In the process of malting the grain is first soaked in water for 40-60 hours when it absorbs sufficient moisture to start germination. This must be quick and even. The grain is thinly spread out on the germinating floor and growth allowed to

continue until the shoot grows about as long as the grain. This takes from 8-12 days according to the variety, the condition of the grain and the temperature. During this period enzymes are activated and part of the starch is transformed to soluble sugars. A small quantity of sugar is used up by the growing seed. The objective is to allow germination to proceed until all the enzymes are activated but not so long that too great a proportion of soluble sugar is used in the growth of the grain. When this stage is reached the germination process is stopped by drying the germinated grain in kilns. The dried product has the roots and shoots rubbed off and is known as malt.

A good malting barley absorbs water evenly, germinates rapidly and evenly, grows quickly and produces a high proportion of soluble extract. Cracked, broken and skinned grains absorb water more quickly than whole and unskinned grains, germinates unevenly and will develop moulds while it is on the germinating floor. An uneven line of barley absorbs water unevenly—some grains get over-soaked and go rotten; some are under-soaked and grow slowly on the germinating floor. Other crop seeds or weed seeds will produce undesirable flavours or an uneven product. Grain with a high nitrogen content is generally associated with a high percentage of flinty grains, with the production of a cloudy extract and with a lower percentage extraction. These are some of the reasons why the maltster requires high quality in his barley and the standards set for No. 1 grade meet these requirements to a high degree.

Soil and Climate

We have already indicated that the growing of malting barley is confined to certain localities, the most important of which are the Blenheim district in Marlborough, the Dunsandel, Lincoln, Ellesmere and Ashburton districts in Canterbury and parts of central Otago and Southland. The most suitable soils for barley are uniform free working loams with a high percentage of sand and a fair state of fertility. High yields may be secured on heavy soils but the ripening on these soils may be too uneven or prolonged, resulting in a high percentage of "flinty" grains. On the other hand light soils may dry out prematurely and the crop dries off rather than ripens. Barley requires an adequate supply of moisture during October and November while making maximum vegetative growth and a cool dry summer for ripening. These conditions, a combination of suitable soil and climate, have been found by experience to occur in the districts mentioned above and maltsters endeavour to secure the bulk of their barley from these areas. It is highly probable that other "new" barley areas will be located in the drive for increased production.

Varieties

Barley varieties may be grouped into two classes: Those suitable for malting and those not suitable for malting. The latter are the Cape and Black Skinless varieties which have already been mentioned as being suitable for green-feed or feed barley. The chief varieties of malting barley grown in New Zealand are:—

1. Plumage Archer:

This is the most widely grown variety being suited to the heavier soil types. It is a broad eared hybrid variety produced by Dr. E. S. Beaven of Warminister in 1905. It was introduced into New Zealand in 1927. The straw is short and erect, and the heads tend to break off at the neck more than some other varieties but it is a high yielder and does not readily lodge. It is suitable for heavy land but not for light land.

2. Chevalier:

This is one of the oldest varieties of malting barley and is of extremely high quality. The strain grown in New Zealand is Kinvers Chevalier. It produces good crops on the light to medium soils. The straw is long and the neck droops when ripe.

3. Spratt Archer:

This is another hybrid variety produced by Dr. H. Hunter in 1908. and introduced into New Zealand in 1923. It is a high quality malting barley with a short strong straw and a drooping head which stands well against wind. It is a good yielder and is commonly grown on heavy land. It is necessary to sow early to get good yields from this variety.

4. Goldthorpe-Spratt:

This variety was introduced into New Zealand in 1924. It is a high

quality malting barley and is proving to be useful in Marlborough and Southland. It is a good variety for medium land but it lodges on heavy land.

The above are the chief varieties of malting barley and their relative importance in New Zealand is indicated by the following percentage area of each.

Plumage Archer	27%
Chevalier	26%
Spratt Archer	20%
Goldthorpe-Spratt	8%
Feed Barleys:	
Cape	10%
Black Skinless	6%

Growing the Crop

Two characteristics of barley, namely its relatively rapid growth and its surface rooting, added to its inability to compete successfully with weeds, determine its place in a rotation. It is normally a spring sown crop and can be sown on a firm fine dry tilth after a cleaning crop such as roots or potatoes, or it can be sown after grass or after another cereal. Barley demands a neutral or slightly alkaline soil and an application of lime is beneficial. The seed is sown at the rate of 1 1-3 to 2 bushels per acre according to the condition of the soil and the time of seeding with 1cwt. of superphosphate in August or early September. Occasionally autumn sowing is practised on the lighter and drier areas, and judging from results during the past four years this practice has much to recommend it.

Harvesting the Crop

It is important that barley should be fully ripe before it is cut. The straw must be free from any sign of greenness and the grain must be hard and the skin finely wrinkled. With older varieties it was necessary to cut before the grain was fully ripe because the heads broke off readily at the neck when ripe. The newer varieties have tougher necks and can be left with reasonable safety until the crop is fully ripe.

The crop may be windrowed and threshed from the windrow with a pick-up attachment fitted to a "header." It is expected that there will be an increase in this method of harvesting barley, and good quality can be secured with careful handling of the crop and intelligent use of the "headers." At present the grower receives 3½d per bushel less for header-threshed than for stook-threshed grain. The latter is the more common method of handling the crop. It is cut with a binder and stooked for 7-14 days or longer according to the weather condition. There is a premium of 4d. per bushel for stack-threshed over stook-threshed grain, the reason for this being that during the time in the stack the grain completes its maturation and during the sweating process the moisture content evens up so that the grain germinates readily and evenly when malted. In order to obtain these results it is necessary for the sheaves to be dry when stacked, the stack well built and thatched, and the crop to remain in stack for three months—six weeks being too short a period.

Threshing

It has been found necessary in recent years to draw attention to the losses and damage that is done to malting barley during the threshing process. In many cases the germ is removed completely from the grain or damaged to such an extent that the germinating capacity of the line is seriously lowered. When grain is injured to this extent, some will also be cracked or broken and some will be skinned to a greater or lesser degree. The effect of this damaged grain in the manufacture of malt has already been discussed. Such damage is caused by the speed of the drum or the close setting of the concave or by both. In general, barley should be threshed with a drum speed considerably slower than that required for wheat. This is the main secret of successful threshing of barley. The drum should run as slowly as possible consistent with efficient threshing of the grain. It is better to lose a few grains in the straw than to spoil the sample by skinning. While the drum is set at a relatively slow speed it is desirable that the speed of the shakers should if possible be increased so as to assist in the separation of the grain from the straw. The ease of threshing barley varies throughout the day with changes in temperature and humidity of the atmosphere and a constant watch must be kept on the grain sample to see that it is not being injured and on the straw to see that threshing is complete. Several adjustments of drum speed or concave setting may be necessary. Regular feeding is im-

portant; and if the hummeler is used it should be set to leave ¼ to ½ an inch of awn on the grain rather than to break the awn off close to produce a "heavy" sample, in which case a considerable amount of skinning will occur.

The screening of the sample may also be responsible for the rejection of an otherwise good line of barley. A maximum of 15 per cent of screenings is allowed but the merchant is permitted to deduct ½d. per bushel for every 2 per cent above 5 per cent, that is, a line with 15 per cent of screenings (quantity passing through a 6A screen) would be valued at 2½d. per bushel less than a line with only 5 per cent of screenings.

Conclusion

Barley growing is restricted to certain districts in New Zealand where the soil and climate have proved suitable for the production of good quality malting barley. There are only four varieties of malting barley of any importance, namely, Plumage Archer, Chevalier, Spratt Archer, Goldthorpe-Spratt in that order of popularity. Approximately 45,000 acres were grown last year of which 82 per cent was used for malting, the balance being used for feed barley. Barley for malting must be of good quality, dry, plump, bright, sound, clean and free from other seeds. Care is necessary in harvesting, particularly in threshing to attain malting standards. Windrowing, stook threshing and stacking are practised. Most barley is grown on contract to merchants. A minimum price and grading standards have been fixed for the different grades.

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ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

Roots and Forage Crop Seed Production

Prepared by the Canterbury Agricultural College, Lincoln.

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In the past the bulk of New Zealand's supplies of certain root and forage crop seeds has been imported from England. This supply is now drastically restricted and the Department of Agriculture has undertaken the task of organising and supervising forage crop seed production in co-operation with various seed merchants in New Zealand. Strict control is necessary for this new industry to avoid under or over supply and to ensure that trueness to type of all the varieties is maintained. This latter requirement is of major importance because all the crops which are included in the scheme will readily cross fertilise with other varieties or with certain other species. For this reason it is unwise for any grower to produce seed of any of the crops concerned unless he has first communicated with the Department of Agriculture in his district. Only those crops grown under supervision will receive official approval and purchasers of New Zealand grown seed should—for their own protection—insist on such a guarantee.

There are some features about this new industry which require special attention. Most of the crops are normally biennials and for seed production purposes it is necessary to time the sowings so that the crop will produce seed within the period determined by its biennial habit. In the first season, the plants normally produce "roots" and it is in this form that they overwinter. In the second season the plants produce flowering stalks and seed, using the store of reserve food in the roots. Where it is desired to select special or typical roots for seed production, these can be pitted over winter and transplanted in the spring. This method is suitable for small areas and for the production of nucleus seed. On the other hand the roots may remain in the ground during the winter and be permitted to produce seed "in situ". This method is reasonably satisfactory for those crops which will stand through the winter, but in most cases the crop runs to seed very unevenly and causes trouble in harvesting.

It has been found by experience that most of the crops can be sown later than the normal seeding time and that where sown thickly in 7in. drills the plants produce a small "root," overwinter satisfactorily and in the spring produce small single seed stalks which ripen more evenly and present few difficulties at harvest time. This is the principle which is now generally recommended and details will be outlined as each particular crop is dealt with.

Another feature of most of these crops is that all the seeds do not ripen at one time and experience is necessary to decide which is the best time to cut in order to secure the maximum quantity of good seed. The heads ripen from the bottom upwards and usually the biggest and best seed is found towards the bottom of the heads. The crop must be cut before this seed has shaken, i.e., it is cut on the green side and ripened in the stook or windrow. The stems are somewhat fleshy and a considerable amount of filling of the seed occurs after cutting, provided they do not dry out too quickly. There are no hard and fast

rules dictating when to cut and a great deal depends upon the judgment of the grower. Until experience has proved otherwise a crop is more frequently cut over-ripe than under-ripe and this practice usually results in the loss of the heaviest and best seed. After cutting the seed must be thoroughly dried before threshing. Drying usually takes ten days or a fortnight for a stooked or windrowed crop. Should the crop be threshed too green, it is well to remember that seed can be further dried in small bag-lots hung up in a shed, or kiln dried by one of the bigger seed cleaning firms. The crops can be cut with a binder or they can be windrowed. Hand cutting might profitably be resorted to for small areas and for parts of the crop which ripen unevenly. The sheaves of these crops which shake readily may be left lying singly, heads up, on tall stubble, or they may be stooked in small stooks which can be forked carefully onto a waggon without tearing the sheaves apart. Threshing is accomplished with the ordinary threshing machines, using plenty of sheets round the machine to collect seed off the waggons and the machine.

Mangels

About eight thousand acres of mangels are grown in New Zealand each year. To sow this area at an average sowing of 5lbs. per acre, approximately 40,000lbs., or 350cwt. of seed is required. An average yield of seed is about 6cwt. per acre so that less than 60 acres will produce sufficient seed for New Zealand requirements. It can thus be seen that to avoid over production, mangel seed growing must be confined to a few growers, unless an export trade develops.

The mangel is a typical biennial. They root over winter and in spring develop tall flowering stems which later produce the seed. For seed production, roots may be lifted in the autumn, stored over winter and replanted in spring. This method is favoured as it permits the selection of typical roots before replanting. During the season 1940-41 a yield of over 10cwt. of machine dressed seed per acre was obtained at Canterbury Agricultural College by this method. Medium sized roots of Prizewinner yellow globe were selected at pulling time. They were stored over the winter and replanted in fallowed ground in September with a 3-furrow plough in rows 30ins. apart and with the plants about 18ins. apart in rows. The roots were dropped off a dray at the required intervals and pressed into the loose soil of the last furrow so that the next round of the plough covered them, leaving the neck exposed. At this spacing about 12,000 roots or 20 tons per acre were required. The crop was inter-cultivated to control weeds and to conserve moisture.

An alternative method is to sow the seed in 7 or 14-inch rows at the rate of 20lbs. per acre in February. Small plants develop during the autumn and these may be left in the ground over winter and allowed to produce seed "in situ" or they may be replanted in early spring in 24 to 28-inch rows, and about 12in. apart in the rows. This method is suitable for propagation of Nucleus seed. It does not permit selection of typical or superior roots.

It is possible to take seed from a crop grown for roots but which has remained in the ground over winter. In this instance it is advisable to nip off the main flowering stems when they begin to develop in the spring to prevent the growth of a single large thick stem and to encourage the growth of several branches of medium size which render ripening more even and harvesting less difficult.

Harvesting

Mangel seed shakes readily when ripe so the crop should be cut when the seed loses its green colour and before it turns brown. The flowering stalks are fleshy and this enables the seed to ripen well after cutting. The crop can be cut with a binder and stooked or for small areas the stems may be broken off and tied by hand. When all the seed is dry and hard it can be flailed or threshed with any of the farm threshers,

Mangels will cross fertilise with

the common garden beets and also with sugar beet. One variety will also cross fertilise with another. They are cross pollinated by the wind and care should be taken that no sugar beet, garden beet, or other variety of mangel is allowed to flower within a mile of the seed area.

Swedes and Turnips

About 350,000 acres of swedes and turnips are grown in New Zealand each year. The quantity of seed necessary to sow this area is approximately 3000cwt. An average yield of seed is about 10cwt. per acre so that around 300 acres grown for seed could provide New Zealand's requirements for this purpose. Further supplies of seed would be required for house gardens, bird feed, etc. Numerous varieties have been imported in the past but the Department of Agriculture has selected some of the chief varieties representing the different types and is now arranging for the production of sufficient quantities of these under new names. Those chosen are:—

White Fleshed Turnips:

New Zealand Green Globe; New Zealand Red Globe; New Zealand Purple Globe.

Yellow Fleshed Turnips:

New Zealand Green Top Yellow; New Zealand Purple Top Yellow; New Zealand Green Resistant; New Zealand Purple Resistant.

Swedes:

New Zealand Superlative; New Zealand Grandmaster; New Zealand Crimson King; New Zealand Resistant; New Zealand Sensation.

It must be stressed here that any grower wishing to produce seed should communicate with the Department because seed not raised under Departmental supervision is likely to cause such a production that growers may be unable to dispose of their uncertified seed to best advantage to themselves.

The methods for growing swede and turnip seed are similar to those described for mangels. In Canterbury, owing to the ravages of dry rot, difficulty has been experienced in over-wintering roots selected for seed production, and this method may not be so reliable as with mangels. It is likely that most seed will be harvested from crops sown at the rate of 2-3lbs. per acre in 7in. rows in February or March and left in the ground over the winter. Alternatively, seed may be taken from part of a winter feed crop which has not been grazed in the winter.

Harvesting

Swede and turnip seed ripens from the bottom of the flowering head upwards and sound judgment is necessary to decide the best time to cut. The best seed is produced towards the bottom of the flowering head and when ripe the seed shakes readily. The best time to cut is when the greater number of the seed pods are of a golden yellow colour and the seeds in these pods are firm and beginning to change colour. Such seeds ripen well after cutting. The crop can be cut with the binder and stooked or the sheaves can be left singly on the stubble. Alternatively the crop may be windrowed. It threshes readily and care must be taken not to shake sheaves when harvesting or to crack the seed in threshing. Birds are liable to be troublesome.

Turnips and swedes cross fertilise readily with wild turnip, with rape and with other varieties but do not cross with the Kales. Bees are the chief pollinating agents and a seed crop should be at least half a mile from a crop which is likely to cross with it. A good yield will vary between 10cwt. and 15cwt. per acre.

Rape

Approximately 200,000 acres of rape are grown each year and the quantity of seed required for this acreage is almost 4000cwt. The average yield of seed is about 10 cwt. per acre. On this basis 400 acres would be required to provide sufficient seed for the above purpose. The practice of growing rape

for seed has been established since the introduction of certified rape seed and the methods of handling this crop are generally known. Rape for a seed crop is usually sown in March at the rate of 4lbs. per acre in 7in. rows. The crop should not be grazed during the winter. It comes into flower in mid-October and the seed ripens in early December. The crop should be cut with a binder when the greater number of pods are of a golden colour and the seed in the more mature pods is firm and beginning to turn colour. When cut too early the seed will be small and shrivelled, and when too late, losses will occur through shaking. The sheaves may be left to dry by placing them with heads up on tall stubble, or the crop may be put up in small stooks so that the whole stook can be forked into a waggon at one time. If sheaves are torn apart when the seed is dry, bad shaking will occur. The crop may also be windrowed and threshed from the windrow.

Rape will cross fertilise with turnips, swedes, wild turnips and with other varieties of rape. A crop for seed should be at least half a mile from another flowering crop.

Choumoellier and Kale

There is an estimated area of 30,000 acres of these two crops and about 700cwt. is required to sow this area. With an average yield of 10cwt. per acre, 70 acres would be required to produce this quantity of seed. These two varieties of Kale can be handled in the same manner as rape except that they take longer to mature and must be sown at the rate of 4-5lbs. per acre in 7in. rows in November-December if high yields of seed are to be obtained. Part of the ordinary crop may be reserved for seed but the stems of the plants are frequently too tall and too thick for convenient harvesting. The thicker seeding recommended reduces this difficulty. As with rape and other root crops seed is being grown under supervision of the Agricultural Department. The crop will cross fertilise with other members of the cabbage family but not with turnips or rape.

Summary

The production of seed of mangels, swedes, turnips, rape and kale is a new industry and is being supervised and controlled by the Department of Agriculture in co-operation with certain firms. Most of the crops are biennials but can be made to act as annuals by sowing thickly and later than the normal seeding times. They are readily cross pollinated and seed areas must be isolated from other varieties and certain other species. The crops are cut on the green side and can be harvested with a binder or windrowed. Farmers who intend to grow seed should communicate with the Department of Agriculture or with the firm responsible for the production of a particular variety of seed.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.

ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

Culling Flock Ewe Hoggets

Prepared by the Canterbury Agricultural College, Lincoln

Bulletin CHRISTCHURCH, NOVEMBER, 1942. No. 160.

Many New Zealand sheepmen firmly believe that the average standard of our better class hill-country flocks has shown no measurable improvement in really important productive qualities over the past twenty years. Though this view may be challenged as representing mere opinion, it is strongly supported by the evidence available from recent investigations into problems of sheep and wool improvement.

If it is accepted as a fair picture of our "progress" in recent times it throws into sharp relief the need to examine critically our sheep improvement methods. In particular, this bulletin aims at directing attention to the possibilities and limitations of improvement through selection and culling of ewe hoggets. Future bulletins will deal with modern views on other aspects of improvement work. Discussions and recommendations herein presented are largely based upon intensive investigations of the Wool Research Section of the Department of Scientific and Industrial Research which is stationed at, and works in co-operation with, the Canterbury Agricultural College. These investigations have covered most types of hill country sheep under both North and South Island conditions. As an example of its scope, the work on the wool side alone has involved individual and detailed examination of some sixty thousand fleeces.

Under practically all hill country conditions, a varying percentage of the young female stock reared annually is culled for sale. This culling margin ranges up to fifty per cent of the total ewe lambs weaned. The immediate question facing us is how the powers of selection thus available may be most effectively exploited by the flock owner.

In culling inferior hoggets and retaining superior ones, the sheepman hopes to select a ewe which will be not only a more productive sheep herself, but also one which will prove a breeder of still more highly productive members of the flock. The first objective aims at immediate returns; the second at future returns. Can both objectives be realised effectively?

Dealing first with the question of the future quality of the flock, it will be obvious that this will be improved only if ewes which are themselves superior individuals actually do leave superior progeny. Insofar as production characters such as fleece and carcase are concerned, this is so to such a small degree that little real improvement can be expected in the progeny of flock ewes selected for carcase and fleece compared with the progeny of ewes which have not been selected for these characters. The reason for this is tied both to the complex mechanism of inheritance and to the overwhelming influence of environment. The effect of the latter in relation to our problem is of special importance. Feeding, climate, disease and management influence very greatly the development of most of the characters of fleece and carcase which are taken into account in selection. In consequence it is impossible to know whether the apparent superiority or inferiority of an individual sheep is due to inheritance or to environment. Because of this, these carcase and fleece behave as weakly inherited characters in contrast with those which are strongly inherited because of their relative immunity from environment effects. In illustration we have recently measured the efficiency with which the characters of the ewe are passed to the lamb, using standards of judgment of fleece and carcase quality normally employed by the breeder. The results with Romney and Corriedale flock ewes fully substantiate the general statements made above. Thus, selection for fleece characters such as high fleece weight is only

about five per cent efficient on the average. In other words, if a mob of ewes, mated to one ram, is divided into two groups so that one group clips one pound more wool per head, the progeny of this group will clip only one twentieth of a pound more wool than the progeny of the lower yielding ewes. A precisely similar result is obtained from selection through the ewe for carcase quality as judged on a basis of conformation and fleshing. Lambs from ewes selected for superior conformation are only about five per cent better than lambs from unselected ewes. In contrast, the type of head is much more strongly inherited. Its desirability, as graded by the breeder, is expressed to the extent of fifteen per cent efficiency in the offspring of superior headed ewes. This is so because, as an early developing bony structure, it is relatively unaffected by feeding and environmental influences affecting other conformation features so markedly. The effect of hereditary factors concerned in its development is accordingly more clearly apparent. Unfortunately, few, if any, important productive characters have been found to be of this type.

A rate of improvement in wool and carcase of the very low order indicated above provides little case for selection and culling of hoggets from the viewpoint of the future flock. The amount of selection normally possible will not permit the quality of the lamb crop to be changed very much by working through heredity on the ewe side. In fact, by comparison with the high degree of control over the following generation made possible by the much more intensive selection practicable in the case of sires, culling of ewe hoggets on the score of future flock improvement can be a misdirection of effect and a waste of the powers of selection available **should such selection conflict with the possibility of improving immediate returns.** It will be obvious that this latter will be the case should culling on a basis of conformation result in the discard of ewes capable of giving a higher return through superior fleece weight.

This general picture results therefore in the rather unusual advice that in the culling of the ewe hogget flock, the farmer should concentrate upon those characters which will result in higher immediate returns from the sheep kept, relying mainly upon wise selection of the ram for the future standard of his flock. This means that we must consider carefully how a ewe contributes to farm income.

During her lifetime she will produce several lambs, several fleeces, and finally her own sale value. These three avenues of cash returns should govern culling methods. On all three counts the first ewes eliminated will be those which, by reason of some deformity or defect of constitution, cannot thrive or rear healthy normal lambs. Defect and deformities appear to be strongly inherited. This provides an equally important reason for their elimination.

From what has been said above, the quality of the lamb crop both in respect of fleece and carcase is not going to be affected much by the fleece and carcase type of the ewes retained. The **quantity** of the lamb crop, however, also affects returns so that selection of ewes which will rear the most lambs is important. Lambing percentage can be improved through the retention of twin hoggets. This is practicable if twins are given a distinctive mark to make them recognisable at the hogget stage as is easily possible where ewes with twin lambs are given preferential treatment in management. On the average large ewes are better milkers than smaller ewes and should produce better lambs. The apparent contradiction in these two requirements, since twins are generally smaller than singles, vanishes at the end of the second year, by which time twins have made up their original deficiency in size. It is important here to emphasise that failure to mark twin lambs so that they are recognisable, together with the usual selection at the hogget stage of the largest sheep, which are usually singles, is working against the maintenance of high fertility in our flocks.

On the wool side, selection and culling can give an immediate and worth while return. The selected ewe produces four to five fleeces after the hogget shearing before she leaves the flock. Any improvement in the standard of the flock by elimination of sheep with inferior fleeces will be realised several times over, provided the first year's fleece is a good indication of the wool produced later in life. Only recently have critical data been accumulated on this point. By following through from year to year large numbers of tagged sheep, it can be stated that the weight of the first year's fleece is at least fifty per cent efficient as a guide to subsequent production. In other words,

hoggets chosen because they clipped one pound above the level of the mob will yield on the average half a pound more wool in each year than will a mob of unselected hoggets. This efficiency will not be as great of course, where weight of fleece has to be judged by eye rather than by measurement with the scales at shearing. On the quality side, errors inevitably associated with eye judgments make the first year's fleece appear less reliable than it really is. The count of the hogget fleece for example is about forty per cent efficient as an index of later fleeces, after allowance has been made for the normal changes in count which affect all sheep alike as they grow older. Wool character of the hogget fleece, which sumarises such features as crimp, staple formation, soundness, hairiness, etc., is rather less efficient because of the greater susceptibility of these features to the effects of feeding and disease, though the relationships are sufficiently strong to be made use of.

In general it can be reliably stated that the hogget fleece is a useful guide to the quantity and quality of the wool a ewe will produce for the rest of her life, so that the removal of poor fleeces by culling at the hogget stage will be of direct benefit to the wool grower. More detailed recommendations as to culling for wool are made below. Before discussing these, however, there remains the question of returns from the eventual sale of the ewe herself.

Apart from the influence of her fleece upon this, which is automatically taken care of in culling for wool as above, the only important feature which could be taken into consideration in this regard at the hogget stage is her carcase conformation. There are several reasons why it is extremely doubtful whether it is worth while bothering about. Aged ewes sold from hill country flocks are bought for fat lamb production. The fat lamb producer is interested primarily in the state of the mouth of the ewe and her size. He aims to get two seasons' production from her and relies quite soundly on the cross with a mutton breed ram to secure the required carcase conformation in the fat lamb. Ewes which are selected and graded for carcase conformation may bring a few shillings more on sale because of their uniformity, but in this even the added value is offset by the corresponding lower price received for the hogget and two-tooths which have been culled because of poor conformation. Since, as has been emphasised above, there is little advantage to be gained on the breeding side by paying much attention to conformation, it is reasonable to suggest that there is no justification for attention to it if selection for carcase reduces the emphasis which can be placed upon wool. This recommendation is not as radical as it sounds if due thought is given to the reasons underly it.

Selection for Wool

Under the wool marketing conditions operating for many years past, quantity rather than quality has contributed most to the wool grower's returns. Future prospects strongly suggest that this situation will become accentuated rather than the reverse. Under these circumstances the most important feature on the wool side is the weight of fleece that the ewe will clip. Fleece weight must be the first consideration in culling.

Unfortunately, it is not practicable to weigh each fleece individually at shearing so that the close relation between the hogget fleece and later fleeces of the same sheep cannot be fully exploited. In grading hoggets for fleece one has to rely upon personal estimates based on judgment of hand and eye. Since these are subject to obvious shortcomings considerable attention has been devoted to the study of methods to aid the sheepman in making his judgments more accurate.

The amount of wool grown by a sheep is determined by four factors: the length of staple, the fineness or coarseness of the fibres, their density on the skin, and the amount of skin area covered. Of these four factors, our investigations show that length of staple is the one which is most closely related to fleece weight. It is further, the one which is most easily estimated with accuracy. Contrary to generally accepted opinion, density is so difficut to estimate accurately, that practically no importance can be attached to it when estimated by hand and eye. The most skilled judges have not been able to show any reliable relationships between their density judgments and fleece weight. Skin cover studies provide no support for the emphasis normally placed upon wool covering on the points and face, factors which are generally considered by sheepmen to indicate more wool per sheep. From a practical viewpoint, the effect of skin cover upon fleece weight can

be taken advantage of only by selecting big sheep.

Considerations of coarseness or fineness merits special attention. Count can be estimated by eye with a high degree of accuracy. It strongly influences fleece weight in such a way that the stronger the count the heavier the fleece. In breeding and selection work, however, it must be considered in relation to the type of country. Farmers have long believed that each class of country is specially suited to growing wool of particular counts, though definite information upon the precise relationships has not been available. From extensive surveys of the type of country over a large number of widely distributed farms, the above belief can be strongly supported and expressed in more definite terms. These may be summarised as follow:—

(a) On the best of sheep country where rainfall is heavy and evenly distributed, and where sheep have as much grass as they can eat throughout the year, Leicester type Romney wool of 40/44 count gives the heaviest weight per ewe, the advantage over wools of 48/50's count averaging three pounds per head. This weight superiority is more than adequate to compensate for the higher price of the finer wools.

(b) On medium class country where Romney sheep are normally run, and where summer and winter feed supplies are less adequate, Romney type fleeces of 44/46 to 48/50 are within the optimum range of count, and give the highest cash return per sheep at the present time. Counts finer than 48/50 are associated with a drop in fleece weight for which the small premium for finer wools is insufficient to compensate. It is likewise not worth while selecting for counts stronger than 44/46, because though yielding heavier fleeces even on this country, the difference is not great enough to make up the drop in price of the very coarse wools.

(c) On the poorer types associated with light rainfall and low carrying capacity, the half-bred type of wool gives the best returns.

The optimum count is about 54/56. There is no advantage to be gained from selecting for wools stronger than 48/50's. Higher weights will be gained at such stronger counts but the increase will be insufficient to counter-balance the normal price difference. In selecting for count at the hogget stage, it must be remembered that the hogget fleece is approximately 1 count finer than that of subsequent years.

Under all conditions short stapled Down-type fleeces are considerably lighter than other fleeces of similar count, while hairy, Carpet-type fleeces weigh lighter than Romney or Leicester type of the same count. Both these Down and Carpet types should be culled automatically.

In respect to other quality features, market conditions are such that weight and not prettiness of wool must be the primary aim. To a very large degree this has been the case for many years in consequence of the gradual replacement of high quality fine wools by artificial fibres for special manufacturing purposes. Such competition must inevitably increase. We are of the opinion that the wool grower can meet the changing market most effectively not by attempting to improve quality but rather by reducing his costs of production by increasing his fleece weight. This he can do. It is more than doubtful whether much success would attend efforts in respect to the finer points of quality.

In advancing the above recommendations we are conscious that the relationship of size of sheep to fleece weight and count must be considered. In the long run it is the wool production per acre that matters to the farmer. Wool clip per sheep is only one factor here. Carrying capacity is equally, if not more important, and the numbers of sheep run is tied very closely to the size of ewe. Definite recommendations as to the best count of wool particularly for medium to poor country should be related to size and carrying capacity. Specific information, however, is not as yet available.

Summary

The recommendations of this bulletin may be summarised as follows:

1. Cull any animal suffering from any deformity or defect of constitution.
2. Select from twins rather than from singles by giving twins a distinguishing mark at birth.
3. Select large rather than small hoggets, providing this does not conflict with selection of twins.
4. Select for fleece rather than for conformation.
5. Select for fleece weight rather than for other wool characters.
6. Select for wool of the type and count most suited to the type of country.
7. In all cases select for immediate returns, leaving improvement of future returns to the wise choice of sires.

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AGRICULTURAL BULLETIN

Quality In Pasture Seeds

Prepared by the Canterbury Agricultural College, Lincoln.

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In recent years the term quality as applied to pasture seeds has come to have two distinct and separate meanings. It is important to distinguish between these two meanings so that confusion may be avoided. Quality may refer to purity, germination, soundness, appearance and weight of the seed itself, i.e. **seed quality.** Seed with a high purity, germination, appearance and weight may or may not produce pastures of high quality and high production. All that good "seed quality" implies is that the seed is sound, clean and alive.

Strain Quality. With the recent advance in our knowledge of pasture plants based on a study of individual plants, scientists have discovered within each species a great number of different forms, varieties or strains. Many of these have been tested under pasture conditions and their merits are known. In New Zealand, the type of cocksfoot originating in the Akaroa district, the type of ryegrass and wild white clover from other districts were found to have special advantages as pasture plants over the then common commercial or imported varieties. A few of the latter were known to have some merit, e.g., Montgomeryshire red clover, but, in general, seed of pasture plants which were imported under the name of perennial and Italian ryegrass, cocksfoot, red clover or white clover were, on the whole, inferior as far as their pasture forming characters were concerned to those special strains which were produced within New Zealand. To distinguish these seeds from New Zealand grown seed a certain proportion (usually 10 per cent) is stained so that a purchaser can readily identify the imported sample.

Thus the term Quality also refers to the ability of the seed to produce a particular type of pasture, i.e., **Strain quality.** For example a sample of perennial ryegrass seed may be capable of producing a highly productive nutritious pasture for several years under good management though the sample of seed may possess any or all of the following seed characters, low germination, low bushel weight, high discolouration, i.e., it is of good **strain quality** but of poor **seed quality.**

The natural strains of pasture plants which were first discovered in New Zealand, were found to be extremely variable in regard to the type of individual plants. Plant breeders selected the desirable plants and from these have produced improved strains. In this way the Grasslands Division of the Department of Scientific and Industrial Research, situated at Palmerston North, has produced improved strains of perennial ryegrass, white clover, Montgomeryshire red clover, Italian ryegrass and is working on other species, and Canterbury Agricultural College has produced an improved strain of cocksfoot.

With the introduction of these specially bred strains of pasture plants a distinction has been made between them, the good natural strains and the inferior strains by a system of certification operated by the Department of Agriculture. The certification of pasture plant seeds has been dealt with in Bulletin No. 125, December, 1939, and reference should be made to that Bulletin for particulars regarding the different pasture plants. An outline of the different classes of certified seed is given in this bulletin because of the importance of a knowledge of certification to farmers who are producing or purchasing certified seeds.

Classes of Certified Seed. Within a particular species the following classes of certified seed are usually provided for:—

1. The first field sowing of a specially bred strain or variety is under the control of the institution or department which produced the particular strain. The seed produced therefrom is referred to as **Nucleus Stock Seed,** and this may be sown on specially selected areas on contract.

2. Government Stock Seed. This is the product of areas sown with Nucleus stock seed. It is the high-

est class of seed a farmer can buy. Wherever certified seed production is the sole objective this class of seed should be sown. Applications for this seed should be made through a seed merchant to the Department for seed for a specific paddock. Applications often exceed the supply, in which case distribution of seed to the most suitable areas and soil types is made. Seed production being the main objective, grazing is recommended only for the control of growth.

3. Pedigree Seed. This is the normal produce of areas sown with Government Stock seed. It can be purchased direct from the grower and is the highest class of certified seed which can be procured through the ordinary trade channels. Intending seed growers who are unable to procure Government Stock seed should aim to purchase Pedigree seed. Areas entered for certification are subject to field inspection. In the case of white clover, seed produced from the area must first be sown in a plot test before certification as "Pedigree" can be granted. This means that the first year's crop cannot be certified in the Pedigree class, nor can subsequent crops be certified in this class until the results of the plot test are known. The first harvest seed is usually disposed of in the Mother seed or Permanent Pasture class. It is necessary, however, that an official sample of the first harvest seed be drawn by an officer of the Department of Agriculture and forwarded for sowing as early as possible so that the results of the plot test are available for certification of the second year's harvest in the Pedigree class.

4. Mother Seed. In the case of perennial ryegrass, this class is the normal produce of areas sown with Pedigree seed but with other species at the present time the natural strains may also be included in the Mother seed class. Mother seed is used for producing high quality pastures but any seed harvested therefrom may be marketed under certification when conditions favour seed production.

5. Permanent Pasture. Commercial in the case of Italian ryegrass, this is a class which includes, in addition to lines of seed of natural strains, all those lines of pedigree strain which are ineligible for certification in higher grades but which are of sufficiently good strain quality to warrant their inclusion in the certification scheme. Field inspections and plot tests are not always required and in some cases laboratory tests are made on samples of machine dressed seed to determine eligibility for certification, e.g., the ultra violet light test for perennial ryegrass and the picric acid test for white clover. Pastures grown from certified "Permanent Pasture" seed will, under good management, come up to the standard expected of the particular species as a grazing area but it will not be suitable for production of certified seed of high strain quality.

Seed which does not reach the standards set for the Permanent pasture class is not certified. This means that as far as the strain quality is concerned it has either not been tested or if it has been tested it is below the standard required for that particular species.

Where seed production is a major objective the highest class of certified seed should be procured for sowing. An endeavour should be made to secure Government Stock seed. When an application for Government Stock seed is unsuccessful the next highest class, namely Pedigree seed should be sown.

Seed Quality. High standards of seed purity are set for the different classes of certified seed and therefore it is necessary at the outset to ensure that the land on which high class certified seed is to be sown must be free from weeds, or crop seeds which will grow with the sown crop and contaminate the harvested seed. Ryegrass and Yorkshire fog plants or seeds in a field sown in cocksfoot are particularly undesirable and are responsible for the degrading of many areas of cocksfoot seed, from certification in the higher classes. Italian ryegrass plants or seeds in or transported to fields in hay containing Italian ryegrass are sources of contamination of perennial ryegrass seed. In a similar manner perennial ryegrass may cause contamination of Italian ryegrass seed and broad red clover may contaminate Montgomeryshire red clover.

It is not a simple matter to ensure that a field is completely free from such injurious plants under average farm conditions because of the movement of stock from field to field; the feeding of hay containing seeds of various grasses and weeds and also the ease with which seeds or plants survive in the field during the growth of other crops, unless special care is taken to destroy them by careful fallowing. The headlands are also a frequent source of contamination. Seed from fence lines can readily become established on the headlands and it may be desirable or necessary to exclude these areas from the main line of seed. The Department of Agriculture has insisted on field inspection of crops entered for certification in the higher grades. Officers

of the Department carefully inspect each field and estimate the proportion of contaminating plants present. When this proportion exceeds a set amount the field is excluded from certification in a high class. It may be eligible for certification in a lower class or it may be excluded from certification. Under very special conditions the inspecting officer may recommend hand roguing the undesirable plants to be followed by a subsequent inspection.

Seed may also become contaminated during the harvesting operations. Here, however, the causes are more obvious and steps can be taken to ensure that machinery and equipment is reasonably clean before entering a certified field. The mower or binder, dray or lorry, header or thresher, must be thoroughly cleaned of foreign seeds, especially those which are likely to spoil the sample. Clean sacks should be used.

Before final certification is granted seeds must reach certain minimum standards of purity, usually achieved by machine-dressing. This process requires skill and care especially when the farmers' dressed sample contains a high percentage of weed seeds or inert matter. The standards of purity which have been set for the different classes of certified seed (machine dressed) are as follows:—

Perennial ryegrass	96%
Italian ryegrass	98%
White clover (with not more than 3% of weed seeds present)	85%
Red clover	96%
Montgomeryshire red clover	96%
Cocksfoot (with not more than 5% of ryegrass present)	70%

Cocksfoot must in addition contain less than ½ per cent of ryegrass to reach pedigree grade. Ryegrass is a very harmful impurity in cocksfoot sown for seed production. The ryegrass plants are so aggressive in the first season that when growing in competition with cocksfoot they tend to dominate the field. Under such circumstances a sample of cocksfoot seed with 0.3 per cent of ryegrass sown at the rate of 10 lbs. per acre could produce over 4840 ryegrass plants per acre or about one per square yard.

Purity and Germination Certificate. After machine dressing an official sample is drawn and sent to the Government Seed Testing Station, where the seed is tested for purity and germination. A certificate is then issued. This certificate gives particulars as to the quality in the two meanings referred to earlier, namely—

(a) Seed Quality. Seed quality involves certification of purity and the certificate gives the percentage of (a) pure seed (b) other crop seeds (c) weed seeds (d) inert matter.

The names of other crop seeds and weed seeds contained in a sample are given by the botanical names only, not the common names. It is important that purchasers should know what some of the weed seeds are, e.g., Californian thistle is referred to as **Circium arvense.** Ragwort as **Senecio jacobaea.** These names mean little or nothing to most farmers. Since it is very important, however, that they should, a list is given of the botanical names of the commoner and more important weeds, the seeds of which are found as impurities in seeds of pasture plants.

Hairgrass	**Festuca bromoides**	Annual Canary grass	**Phalaris minor**
Goosegrass	**Bromus mollis**	Wireweed	**Polygonum aviculare**
Cats-ear	**Hypochaeris radicata**	Field Madder	**Scherardia arvensis**
Sweet Vernal	**Anthoxanthum odoratum**	Field Melilot	**Melilotus**
Ribgrass	**Plantago lanceolata**	Haresfoot trefoil	**Trifolium arvense**
Sorrell	**Rumex acetosella**	Knotted clover	**Trifolium striatum**
Dock (curled)	**Rumex crispus**	Hop clover	**Trifolium agrarium**
Californian thistle	**Circium arvense**	Creeping Fog	**Holcus moliis**
Hawk weed	**Crepis capillaris**	Onion twitch	**Arrhenatherum elatium var bulbosum**
Ox-eye daisy	**Chrysanthemum leucanthemum**	Annual poa	**Poa annua**
Fathen	**Chenopodium album**	Bladder campion	**Silene inflata**
Chickweed	**Stellaria media**	Wild turnip	**Brassica campestris**
Hawkbit	**Leontodon hispidus**	Wild turnip (Charlock)	**Sinapsis arvensis**
Scarlet Pimpernel	**Anagallis arvensis**	Hoary cress (swine cress)	**Lepidium draba**
Catch fly	**Silene gallica**	Burr clover	**Medicago denticulata**
Dodder	**Curcuta epithymum**	Ragwort	**Senecio Jacobaea**
Spurry	**Spergula arvensis**		
Self Heal	**Prunella vulgaris**		
Spotted Burr clover	**Medicago maculata**		

The percentage and names of "Other crop seeds" and "Inert Matter" are also given.

Other Crop Seeds

Perennial ryegrass	**Lolium perenne**	Timothy	**Phleum pratense**
Italian ryegrass	**Lolium italicum**	White clover	**Trifolium repens**
Yorkshire Fog	**Holcus lanatus**	Suckling clover	**Trifolium dubium**
Cocksfoot	**Dactylis glomerata**	Red clover	**Trifolium pratense**
Crested dogstail	**Cynosurus christatus**	Olsike	**Trifolium hybridum**
Kentucky Blue grass	**Poa pratensis**	Lucerne	**Medicago satina**
Brown Top	**Agrostis tenius**	English trefoil	**Medicago lupulina**
		Black medick	**Medicago lupulina**
		Bird's foot trefoil	**Lotus spp.**

The certificate also give the percentage of germination and in the case of clovers the percentage of "Hard Seeds." Finally the percentage of "pure living seed" or "real value" is calculated by multiplying the purity percentage by the germination percentage and dividing by 100. In the case of white clover the germination is obtained by adding one-third of the "Hard Seed" to the actual germination. The date of the test, the station test number, and the registered number of the particular field from which the seed was harvested are also given on the certificate.

Other factors concerned with seed quality, namely bushel weight and appearance, etc., are not recorded.

(b) Strain quality. As previously mentioned this refers to the type of pasture the seed is capable of producing. If, after field inspection, plot test, or seed test, the type or strain is up to the standard set for qualification in the certification scheme then the particular class is marked on the official purity and germination certificate as "P.P." for Permanent Pasture class, "Mother" for Mother seed class, "Pedigree" for the Pedigree class. All certified seed certificates are labelled **Certificate of Analysis—Govt. Certified Seed** printed in red. Certificates of non-certified seed refer to Purity and Germination only and are not labelled in red. Each sack of certified seed is sealed and a certification tag is attached on which the class of seed is clearly marked. A reference to the Purity and Germination (P. & G.) certificate is also given. An insert slip is put inside each sack with similar particulars to that on the tag in those cases where a knowledge of the seed sown is necessary in deciding eligibility for certification.

Every farmer who grows certified seed should make himself familiar with these terms and a purchaser of certified seed should demand a copy of the covering certificate so that he knows both the **seed quality** and the **strain quality** of the seed he is sowing.

Canterbury Agricultural College plays an important role in the distribution of certified pasture seeds. Nucleus Stock seed areas of ryegrass (Italian, perennial and Short Rotation), white clover and Montgomeryshire red clover are grown on contract to the Agricultural Department. Nucleus Stock cocksfoot is produced for distribution by the College. Seed from these propagation areas is then distributed to farmers by the Department, or by the College in the case of cocksfoot, through merchants as Government Stock seed. The College also sows areas in Government Stock seed and the produce from these areas is sold through the ordinary commercial channels as Pedigree seed.

Summary and Conclusions

Seed Quality refers to the purity, germination and soundness of seeds. Assessment of this quality is carried out by the Government Seed Testing Station and a certificate showing the result of the seed sample examination is issued by the Department of Agriculture.

Strain Quality refers to the ability of the seed to produce a pasture of the desired type. Assessment of this quality is carried out by the Department of Agriculture through its Certification Organisation.

Seed quality bears no necessary relationship to strain quality. The farmer is safeguarded against the purchase of inferior strains by the certification system under which seeds of recognised strain quality are sold in sealed sacks carrying the certification tag clearly showing the class of seed contained in the sack.

A list of common weed seeds found in grass seed samples is given including both the common English name and the botanical name by which they are recorded on the certificate.

Growers of seed crops should do all they can to prevent contamination of harvested crops (1) by growing on clean land and (2) by thoroughly cleaning harvesting machinery.

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CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

Transport Losses in Fat Lambs

Prepared by the Canterbury Agricultural College, Lincoln

Bulletin CHRISTCHURCH, JANUARY, 1943. No. 162

Fat lambs, particularly milk lambs, are subject to considerable loss in both weight and quality between farm and slaughter. They are by far the most vulnerable of our meat animals in this respect. Their special liability to loss of bloom and to loss of weight has been recognised since the earliest days of the industry by both farmer and meat operator. In consequence, the whole of the processing side of the fat lamb industry has developed on the basis of an almost traditional belief in the desirability of rapid treatment of lambs at freezing works. Time between farm and slaughter has been cut to a minimum by the strategic placing of works, by the development of specialised methods of motor and rail transport and by organisation of buying activities. At all stages, lambs are handled by men trained to work and alive to their responsibilities.

In view of this situation, it is rather surprising that no reliable data exist on the extent of the losses in weight and quality under different transport methods. Accumulated experience has indicated strongly that such losses occur but no precise information appears to have been collected. The desirability of having such information available became apparent at an early stage in the present war in consequence of the transport problems created by the shortage of petrol and rubber. The curtailment of motor services, the diversion of lambs from road to rail and the consequent increase in transit time between farm and freezing works have raised questions as to the relative economy of varying transport conditions. Such questions are capable of answer only by controlled experiment. During the 1940-41 season the Animal Husbandry Department of the Canterbury Agricultural College, in co-operation with the North Canterbury Farmers' Freezing Co., carried out experiments, the results of which are of considerable interest.

That great care and specialised rapid treatment are necessary in the handling of immature animals such as fat lambs, is only to be expected in view of the very high water content of the fat lamb carcase. It will be observed from Table I. that approximately half of the weight of a fat lamb consists of water. The lean meat which accounts for over half the carcase contains over seventy per cent water; the fat tissue, making up one-third of the carcase, contains 20 per cent water; while even the bone contains forty per cent. A prime Canterbury, 34lb. lamb thus contains about seventeen pounds of water.

TABLE I.

COMPOSITION OF PRIME CANTERBURY LAMB

	% Carcase	% Water
Bone	11.7	40
Muscle	52.5	72
Fat	32.4	20

Loss of water from the body is a constant process and is part of the mechanism employed by the living animal to maintain its body temperature at a constant level. A fat lamb normally loses one-tenth of a pound of water per pound in this manner. Normally, this loss by evaporation from the body surface through the sweat glands and through the respiratory tract is made good by water taken in through the food. The removal of lambs from their food, cuts off this replacement supply, while losses be-

come greater in consequence of the added exercise of droving and handling. Thus, a day or two without food or drink, along with the accelerated loss of water from increased exercise, must be expected to reduce the body weight of the lamb. Some such loss is obviously unavoidable. From the view point of the farmer, who is paid on weight of lamb supplied, it is equally obvious that the loss should be reduced to a minimum.

Reduction in quality is also liable to occur under certain circumstances. Lambs subjected to undue delay between drafting and slaughter may suffer in "bloom" and thus fail to measure up to prime quality standard. "Bloom" in a fat lamb is largely tied to the quantity, quality and distribution of the fat in the carcase. When an animal is deprived of food, life processes must continue. Fat provides the reserve nutrition which is drawn upon for this purpose. Some of the water lost in keeping down body temperatures also comes from the fat tissue. Should such withdrawal become at all extensive, quality will undoubtedly suffer. Serious loss under this heading, however, is hardly to be expected in New Zealand even under the most inefficient methods of transport. Most fat lamb farms are sufficiently close to freezing works to avoid the three or four-day interval which appears to be necessary before any notable deterioration in quality occurs. In countries such as Argentine, where distances of one thousand miles or more, and time intervals from four to seven days, between farm and works exist, deterioration in quality is sufficient to convert prime quality lamb into third grade.

Transport Methods: Effect on Weight

It is commonly accepted that rapid transport by motor truck and slaughter on arrival at works provides "ideal" transport conditions since time interval is thereby reduced to a minimum. For purposes of comparison, in our experiments, this method was adopted as a basis, and control groups of lambs were killed under these conditions. With these were compared groups of lambs also carried by motor truck but killed after holding periods at the works varying from twenty-four to forty-eight hours. In addition, comparable lambs were carried under typical Canterbury rail transport conditions. These latter involved droving eight miles to rail-head, overnight railage, arrival at works the following morning and slaughter twenty-four hours after leaving the farm. The first series of experiments involved two hundred Southdown X Corriedale milk lambs in groups of fifty, and the second series some six weeks later, involved two hundred and forty Corriedale rape lambs in groups of eight.

The treatments employed may be summarised as follows:—

Group A

Direct to works per motor lorry, killed on arrival (eight hours after drafting).

Group B

Direct to works per motor lorry, killed twenty-four hours after Group A (thirty-two hours after drafting).

Group C

Walked eight miles to rail-head, trucked per train overnight to works and killed with Group B (thirty-two hours after drafting).

Group D

Direct to works per motor lorry, killed forty-eight hours after Group A (fifty-six hours after drafting).

All lambs were picked by the fat lamb buyer as in normal practice. They were then individually weighed and identified by eartag, randomised on a live weight basis into the different groups, and followed through to the works where slaughter data were obtained. Drinking water was available to the lambs while waiting slaughter at works. It was noticed, however, that little use was made of this during the first twenty-four hours, the lambs apparently requiring this period to settle down in their new surroundings.

TABLE II.

SERIES 1: MILK LAMBS

Group	Farm Live Weight	Works Carcase Weight	Loss in Carcase Weight
	lbs.	lbs.*	lbs.
A	76.1	37.3	—
B	76.1	36.4	0.9
C	76.1	36.5	0.8
D	76.1	35.8	1.5

SERIES 2: RAPE LAMBS

Group	Farm Live Weight	Works Carcase Weight	Loss in Carcase Weight
	lbs.	lbs.*	lbs.
A	69.6	34.3	—
B	69.6	33.3	1.0
C	—	—	—
D	69.6	32.8	1.5

*Works weight=Hot Carcase weight less 4½ per cent.

The results indicate that the major factor influencing the amount of loss in the carcase weight of lambs transported in different ways is the period of time between leaving the farm and slaughter at the freezing works. Thus compared with quick motor transport and immediate slaughter, lambs similarly carried but killed twenty-four hours later showed a loss of approximately one pound each in carcase weight.

Lambs similarly carried but subjected to a delay of forty-eight hours before slaughter showed a loss of approximately one and a half pounds per head. These losses with milk lambs were confirmed with rape lambs where the results were in close agreement.

Lambs submitted to typical rail transport killed out at the same weight as those carried by motor truck which were killed at the same time after leaving the farm. Thus, there would appear to be no harmful effect on carcase weight of rail transit in itself. Since the fact of having to carry by rail, however, involved a time interval of twenty-four hours between farm and slaughter, the lambs so carried showed a loss of approximately one pound per head compared with the "ideal" treatment of motor transport and immediate slaughter. The relatively longer period of time between farm and slaughter necessarily associated with rail transport under most conditions places this method at some disadvantage compared with more rapid motor transport.

While the above summarises the major results to date, strong evidence was obtained also which indicated that weather conditions during transit and during the holding period at the works plays a large part in transit losses. During dry, hot north-west weather conditions, losses in the course of other experiments tended to be considerably higher than during cold, wet weather. Thus, lambs held as long as seventy-two hours between farm and slaughter during the latter conditions lost only half a pound compared with a loss of a pound and a half in lambs held only forty-eight hours during north-west weather conditions. This situation is not unexpected since the greater part of the loss involved is a loss of water from the body, evaporation from which will be greater during high temperature—low humidity conditions. This aspect will be the subject of further study as opportunity permits.

Transport Methods: Effect on Quality

All lambs were graded by the Works Grader as in normal commercial practice. In addition, the grader carried out a special examination of "bloom," allotting points to each carcase. Special pointings were also made for fat cover and quality on rump, loin, shoulders and legs. No measurable differences in any quality point were recorded between the different groups. It is of interest to note that this applied to the milk lambs no less than to the rape lambs, which are generally supposed to be less vulnerable than lambs drafted straight from their mothers. It is also of importance to record that there were no signs of damage due to inefficient handling in the lambs driven to rail and railed to works. Rather was the reverse the case, there being several bruised lambs amongst those carried by motor lorry.

Though weight had been affected, carcase quality thus remained unimpaired as judged by standards more severe than those employed in commercial grading. It can be safely argued, therefore, that quality is unlikely to be adversely influenced by interval between farm and slaughter of up to two days.

Disadvantages of Rapid Transport

While rapid transport of lambs is of definite advantage to the farmer, it must be recognised that there are possible disadvantages in shortening too much the period between farm and works. If lambs are killed too soon after leaving the farm, dressing is more difficult. The lambs are harder to skin and dress with the result that grading may be affected through cuts or poor

skinning, pelts may be damaged and reduced in value; or carcases may be stained with gut contents. For these reasons, operators prefer to handle lambs which have not received food too soon before slaughter and, in general terms, prefer a twenty-four hour interval. These points are important in emphasising that, in normal times, the farmer should be reasonable in his demands on the operator insofar as quick transport and early slaughter are concerned.

It will be noted that the loss is entirely one of water. To the operator this also is important in that lambs that have already lost some weight tend to lose less in cooling, freezing and storage. All the lambs in the experiments described above were weighed after cooling and again after three months cold storage. Those losing least between farm and slaughter lost most after this stage, so that differences between the groups tended to be ironed out.

Summary

Summing up the position, it is an undoubted advantage to the fat lamb farmer to be provided with rapid transport facilities. Transport method involving a delay of twenty-four hours in slaughter may be expected to reduce the weight of lambs supplied by approximately one pound per head. Diversion from road to rail is likely to involve this delay in most cases. The loss in weight is one of water loss and thus does not affect the weight of nutritive material supplied.

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CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

THE SELECTION OF RAMS FOR HILL COUNTRY SHEEP FLOCKS

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Each autumn sees the transfer of some thousands of rams from stud breeders to hill country sheep farmers mainly through the agency of the Ram Fair.

The buyers of these rams hope that they have purchased sheep which will give some improvement in the future flock but, at the same time, they know from past experience that the chances are very great that their hopes will not be realised. This difficulty of ram selection is not peculiar to New Zealand farmers for Fraser, in his excellent work on "Sheep Farming," written for English farmers, says 'Rams are difficult to buy. Some men I know feel safer buying fifty ewes than five rams. The fashionable lady most skilful in "make-up" is an innocent child compared with the experienced shepherd of pure-bred sheep. I think that, for commercial purposes, it is better to purchase the cheaper rams from a well known flock than to search for individual excellence.'

There is no need to elaborate these views at this stage but we can remind ourselves that they may well have been written of New Zealand experience.

Bulletin 160 of this series, which deals with the 'Culling of Flock Ewe Hoggets,' points out that in our better class hill country flocks, no measurable improvement in important productive qualities has been achieved during the past twenty years. It shows that, while the selection of individual ewes for superior producting qualities will result in an improvement in immediate returns, this improvement is handed on to the progeny of the ewes to such a small extent that the future flock will receive no appreciable benefit. In this same bulletin it was emphasised that any improvement in the producing qualities of the future flock must come through the sire and still further that such improvement can only be expected if the sires used are inherently capable of producing offspring superior to the existing flock under the environmental conditions concerned.

It is paradoxical that the means of selection over which the farmer has direct control should be so ineffective in its results while ram selection, in which he takes little active part, in that most of the selection and culling has already been done by the stud-breeder, should have more far-reaching effects. The reason for this lies in the higher general standard of quality and productivity of the high class stud flocks and in the fact that selection of the better rams from such a flock represents much higher rate of culling than is practicable amongst hill country ewes. This is another way of saying that the standard of individual quality of selected rams can be so much higher than that of the average quality of hill country flock ewes that some improvement in progeny can be expected.

At the same time, it should be clearly understood that the reasons which make individual appearance and performance of a ewe an unreliable guide to her ability as a breeder of better progeny, apply equally to the ram. That an individual ram is outstanding in appearance and in fleece weight is no guarantee that he will leave progeny better than the average of the existing flock. The greater the difference between him and the existing flock, however, the greater

will be the chance of his improving the future standard.

Even greater importance should be attached to the difference between the average productive quality of the flock in which the ram is bred and that of the flock in which he is to be used. Rather than looking for improvement from rams drawn from a stud flock characterised by a few outstanding individual sheep, rams should be obtained from stud flocks where the standard of quality is uniformly high.

Recent investigational work has shown that the extensive use of sires which have proved successful when progeny tested would lead to spectacular improvements in economic characters in a very short time. Improvement is both so certain and so much more rapid than that possible by straight selection that there is a temptation to recommend the use of progeny tested sires and their sons. Unfortunately, though this would be scientifically sound, such sheep, tested for the characters which are all important in the hill country flock, do not exist, and until such time as sheep men demand some measure of progeny performance tests, stud sheep breeding will remain largely an art of reproducing fashionable types, and the purchase of rams for flock sires will remain very much the gamble at long odds that it is at present. Sheepfarmers have something to learn from dairy farmers in this connexion. The latter have organised methods for the location of 'Proven sires' already working on a national scale. The expedient, adopted by some Breed Societies and Ram Fair authorities, of inspecting sheep offered for sale as a means of eliminating 'apparently' inferior animals has little, if any, real effect and merely results in keeping fashionable types before the public. Because Breed Societies are primarily interested in breed type, rejection for lack of economic characters must take second place to rejection for departure from breed standards.

Stud breeding is a business. Success is measured in terms of annual sales. The breeder is alive to the importance of the selling side and knows full well that in the sale ring his animals must **look** good. To achieve this end, a combination of breeding practices, heavy feeding and sale preparation is necessary. Successful stud flocks are found invariably on the best farming lands. The old axiom that half the breeding goes down the throat is another way of saying that mediocre animals can be made to look like good animals if given very favourable conditions while very good animals will look only mediocre under unsuitable environment.

Investigational work has shown that the axiom is even more true than the breeder realises and sounds a note of warning which must be heeded when estimating the value of a handsome individual in the sale ring. To further impress the buyer, a course of sale preparation is embarked upon which entails early shearing and shaping out so that in late summer the sheep carry at least a threequarter fleece. Skilful trimming aids in covering faults and emphasising good points.

There is no need to labour these points as they are recognised and accepted by sheep men. Provided buyers can maintain a sense of balance and apportion superiority and inferiority to the correct sources, little harm is done. Indeed there is some justification for stud sheep being bred under conditions appreciably better than those enjoyed by grade sheep, for it is only then that differences in ability become sufficiently well marked for effective selection to be carried out.

It is extremely important, however, that the conditions should not be so much better that they result in the development of sheep unsuited to the commercial wool flock. For this reason it is sound practice to avoid sheep that are bred under feeding conditions too artificial or divergent from practical field conditions.

With all the pitfalls confronting the prospective buyer of flock rams, what steps can he take to reduce the chances against him? A great deal depends upon his experience, knowledge and sound judgment but as far as advice can be given, the following principles should guide him.

1. **Select from a stud flock which has shown itself capable of supplying rams that are improvers under the conditions where they are to be used.** Maintenance of this policy is additionally sound in that it involves sticking to the one strain, leading thereby to greater uniformity. It is unwise

to chop and change from one breeder to another especially when their flocks are divergent in type and relationship.

2. **Select individual rams with the type of fleece suited to the country they will breed on.** This means:

(a) On the best of sheep country where rainfall is heavy and evenly distributed, and where sheep have as much grass as they can eat throughout the year, Leicester type Romney wool of 40/44 count gives the heaviest weight per ewe, the advantage over wools of 48/50's count averaging three pounds per head. This weight superiority is more than adequate to compensate for the higher price usually ruling for the finer wools.

(b) On medium class country where Romney sheep are normally run, but where summer and winter feed supplies are less adequate, Romney type fleeces of 44/46 to 48/50 are within the optimum range of count, and give the highest cash return per sheep. Counts finer than 48/50 are associated with a drop in fleece weight for which the small premium for finer wools is insufficient to compensate. It is likewise not worthwhile selecting for counts stronger than 44/46, because, though such yield heavier fleeces even on this country, the difference is not great enough to make up for normal drop in price of the very coarse wools.

(c) On the poorer types associated with light rainfall and low carrying capacity, the half-bred type of wool gives the best returns. The optimum count is about 54/56 but there is no advantage to be gained from selecting for wools stronger than 48/50's. Higher weights again will be gained at slightly stronger counts than 48/50's but these will be insufficient to counterbalance the normal price difference. In selecting for count at the hogget stage, it must be remembered that the hogget fleece is approximately 1 count finer than that of subsequent years' wool growth.

(d) It must be remembered that the rams must be somewhat coarser than the ewes to which they are mated. In general terms this means some 2-4 counts stronger than the flock count aimed at.

3. **Select individual rams having conformation which suggests reasonable carcase quality.** Less attention should be paid to this than to wool since wool returns more to the hill country farmer than carcase and since the latter is taken care of by the use of specialised fat lamb sires in the production of fat lambs. (See Bulletin 139).

4. **Select rams that are twins rather than singles.** This is important, not because twin rams leave more lambs than singles but because daughters of twin rams are more likely to inherit the twinning character.

5. **Select rams which are obviously sound** in feet, mouth and reproductive organs and free from defects likely to be inherited.

6. **Select rams privately.** This is of distinct advantage over the ram fair for reasons which will be obvious from what has been said above. In addition, it enables the buyer to select rams individually rather than relying on the remote chance of finding the type required all in the same pen at a ram fair, where most breeders arrange the groups so that the good will help to sell the bad. It also enables the buyer to inspect the flock of the breeder and to assess its average quality and uniformity.

7. **Select rams from flocks where conditions of climate, feeding and management do not diverge too much from the environmental conditions** of the flock where they are to be used.

In advancing these recommendations it is of course assumed that the reader has a sound knowledge of sheep and a clear idea of his objectives as a farmer. Accordingly, no apology is needed or offered for not dealing with the subject in the usual way where the good and bad points of a sire are set out in detail. Indeed it is rather assumed that the modern sheep farmer is fully aware that wool and carcase, as the two contributing factors to his income, far outweigh in importance the many minor characteristics of type and beauty to which too much attention is often paid by the inexperienced. It must never be

forgotten that in breeding animals it is not merely twice as difficult to breed for two characters at a time rather than for one, but is four times as difficult, that to get a flock breeding true for three characters is nine times as hard as for one and so on. Concentration on too many characters is thus a definite weakness in selection. It is doubly so when many of the characters involved are of no economic importance. A realistic approach to sheep improvement is more than ever necessary under the conditions facing the sheep industry; such an approach cannot afford to consider features which do not add to farming efficiency and which, in any case, merely accentuate breeding problems.

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FLIES AND THEIR CONTROL ABOUT BUILDINGS

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This bulletin deals mainly with the common house-fly which constitutes well over 90 per cent of the flies which frequent dwelling houses and most other buildings. At certain times of the year and under certain weather conditions, other forms such as blow-flies, lesser house-flies, and biting stable-flies may enter in considerable numbers, but these are of minor importance compared with house-flies.

1. Life History of the Common House-Fly: The house-fly can breed continuously throughout the year but breeding is much more rapid in summer than in the colder months of the year. A female fly lays her eggs in batches, about 120 eggs to a batch, and this she does at intervals during her life which may extend over two to three months, and in that time she may lay over 1,000 eggs. The eggs hatch, during warm weather within 24 hours, into white legless maggots. Most people are familiar with the appearance of maggots, if not those of the house-fly, at least those of the nearly related blow-fly which attacks meat, fish, carrion of all kinds, sometimes even live sheep and occasionally clothing and blankets. House-flies, on the other hand, are not so commonly attracted to such material. Almost invariably they lay their eggs in dung, particularly horse manure, and other moist decomposing vegetable matter. The maggots, after feeding for 5 to 6 days (much longer in cold weather) creep away to a drier and cooler place to pupate. After a few days, under favourable conditions, the full grown fly emerges from the oval, brown pupal case. Freshly emerged flies are rather white-bodied, shrivelled creatures with crumpled wings, only able to crawl or jump, but very soon they fill out, darken in colour, expand their wings and commence their normal adult activities. From the time the adult emerges until egg laying commences, a period of from one to three weeks must elapse. In summer when breeding is in full swing the life cycle from egg to adult fly may be completed in less than a fortnight.

As a breeding ground house-flies prefer, above everything else, fresh horse dung, but they will breed readily in the fresh excrement of almost any animal including humans. It is this natural habit of visiting indiscriminately human excreta and human food that makes house-flies so objectionable and so important in the transmission of intestinal diseases. Besides faecal matter, house-flies breed in garbage, decaying vegetables and fruit, sludge, in fact decaying animal and vegetable matter of all sorts, even in a pile of lawn clippings if suitable moisture and heat are present to permit fermentation. House-flies require a moist breeding ground where active fermentation is going on. Dry material, whatever its origin, is quite useless for breeding purposes.

2. Habits: House flies cause restlessness and irritation to animals and people alike, by alighting on and crawling over the exposed parts of the body. They induce a feeling of nausea by crawling over food and utensils. They swarm into houses and soil window panes, electric lamp globes, walls and wall-papers, curtains, pictures and wood

work. Their legs are well furnished with bristles and so they may carry filth from dirty surroundings to human food.

The main indictment, however, is the positive danger to the health of the community where house-flies are abundant. There is ample evidence to prove that flies are capable of transmitting a number of diseases, the main ones being typhoid and paratyphoid fevers, cholera, dysentery (both bacillary and amoebic) and summer diarrhoea. In the case of several others, such as anthrax and tuberculosis, the house-fly is suspect. The eggs of various species of tapeworm have been known to be swallowed by flies and have been passed out in their excrement and so flies could very well be implicated in the transmission of hydatids. Flies are also believed to play a part in the transmission of certain diseases whose causative organisms occur in discharges from the eyes or from open sores and wounds. Two cases are recorded of the detection of the virus of poliomyelitis (infantile paralysis) in flies during epidemics of the disease in the U.S.A. in 1941.

House-flies are capable of travelling long distances. Besides being carried for scores or hundreds of miles in motor cars, railway carriages, or aeroplanes, they can fly readily of their own accord distances of over ten miles. In open country districts they probably travel much greater distances than in built-up town areas. Because of this tendency to wander, fly control should be a community measure and not an individual matter. An individual can protect his house by careful screening or continual trapping and poisoning, but to get rid of flies the whole community must co-operate. A single neglected manure heap can produce enough flies to over-populate a whole township.

3. Control Measures. It is much easier to eliminate the breeding places or destroy the maggots than to deal with the fly in the adult stage. House-flies breed in fresh manure (chiefly horse dung), garbage, and all manner of decaying matter. Blowflies, on the other hand, breed in decaying meat or carcases. To eliminate breeding places, all such material should be deeply buried, burned, enclosed, screened, or specially treated.

(a) Manure Treatment: Animal manure may be rendered useless for breeding purposes if it is spread on fields in a thin layer so that it dries out quickly. Certain chemicals will destroy the maggots in manure heaps, but many chemicals injure the fertilising properties of the manure and they are usually expensive. One of the best and safest substances is borax used at the rate of 1lb. to 16 cubic feet. The powdered borax should be dusted evenly over the surface, and the pile then sprinkled with water, or the borax may be dissolved in water and sprayed on. Hellebore has been successfully used in this connexion, but is more expensive. A solution is made from ½lb. Hellebore in 10 gallons of water and allowed to stand for 24 hours. The 10 gallons are sufficient to treat 10 cubic feet of manure, the solution being sprinkled over the surface of each day's output. Hellebore will not harm the manure and borax-treated manure is not harmful to agricultural land if applied in moderate quantities (not more than 15 tons per acre).

(b) Maggot Traps. Several different types of maggot trap have been developed to catch maggots as they crawl away from their feeding grounds to a dry, cool place to pupate. Manure can be stored on a slightly elevated platform or bin with perforated floor and the pile kept sufficiently moist to compel maggots to seek a drier place to pupate. They crawl downwards through the perforated floor and drop into a concrete basin containing water covered by a film of oil and are drowned. A variation of this method is to pile the manure on a concrete floor sloping downwards at the edges and surrounded by a gutter filled with any suitable fly poison or disinfectant. A low wire-netting enclosure is erected on the floor to prevent the manure falling into the gutter. The manure should be packed tightly and the edges of the gutter should overhang

slightly to prevent maggots from escaping.

Where the use of such traps is impracticable advantage may be taken of the fact that the heat of fermentation in a large well-compacted pile of manure will destroy maggots. The outer layer, which remains a suitable breeding ground, may be dealt with by digging a hole in the centre of the pile each day and shovelling the superficial layer into it; or the heat in the pile may be increased by covering with a tightly packed layer of earth, with a tarpaulin or with oil-soaked sacking. In attempting to control fly numbers, the chief aim should be to eradicate their breeding grounds.

(c) **Adult Traps.** Once breeding places have been attended to, the population of flies will be reduced to a level where measures for coping with the adults are worth while. There are many different kinds of fly trap. All designs, however, are based on two well-established facts; first, flies are led into the trap by their sense of smell and attempt to escape towards light, and second they crawl upwards rather than downwards. Well-designed and efficient fly traps may be purchased, but with a little care and patience quite useful traps may be constructed at home. One of the simplest to make is the garbage tin trap with close fitting lid. A hole 3in. in diameter is made in the lid, the edges of the hole being turned up a little to form a lip. Over this hole is placed a wire cone, apex upwards, the opening at the apex being just sufficiently wide to allow a fly to crawl through. Over the cone is placed a glass or fine mesh wire bowl, which when resting on the lid stands a few inches clear of the apex of the cone. The cone should have a flange to lie flat on the lid and the bowl rests on this flange so that bowl and cone can be lifted off as one piece. Entrance slits about ½in. wide and 3in. long are cut low down on the sides of the bin. In cutting entrance holes, do not remove the piece but make one cut 3in. long, two cuts each ½in. upwards from the ends of the long cut, then bend the piece inwards so that it is directed inwards and upwards like an L. This permits flies to enter but excludes light. The bin may be baited with liver, meat scraps, over-ripe bananas or any sort of decaying matter, all of which remain attractive for a considerable time if kept moist. Flies are attracted to the bait and when they have finished with it they fly upwards to the light, crawl through the narrow apex of the cone, and are trapped in the bowl and may be disposed of periodically.

A very similar type of trap may be constructed from two 4-gallon kerosene tins placed one upon the other. The tins must be washed clean so that no odour of kerosene persists. The lower tin has the upper end cut away and entrance holes cut on the sides, and acts as a bait chamber. The upper tin which is to act as the fly chamber, has the lower end cut away, wire gauze windows made in the sides and upper end, a wire gauze pyramid, apex upwards, fixed inside, and strips of wood fixed to the edges of the lower end so that the upper tin rests squarely on the lower. The flies enter the bait tin and pass up through the pyramid to be caught in the upper tin. The upper tin with fixed pyramid can be lifted off when full and the flies destroyed.

A type of trap for indoor use is the window trough. The trough is a tin vessel 1in. wide and 1½in. deep and as long as the window pane is wide. The trough is partly filled with water, a film of kerosene poured on top and then placed with one edge pressed against the window pane. This trap is particularly useful for catching blowflies which crawl up the pane and on blundering down, fall into the trough and are drowned.

Sticky fly papers can be used in dwellings, or wires coated with a sticky mixture can be suspended in large buildings and places frequented by flies. A sticky mixture for use in coating wires may be prepared by heating 4lbs. of resin in 1 quart of castor oil and stirring until a clear solution is obtained. This mixture is also suitable for applying to papers if they have glazed surfaces.

Flies can be destroyed in houses by a crude sort of fumigation, using the fumes of burning insect powders or sulphur or they may be destroyed by spraying with one of the commercial preparations. A suitable fly spray is prepared by adding ½lb. pyrethrum powder to one gallon of kerosene (water-white kerosene to prevent stain marks), stirring at intervals to dissolve the pyrethrum and then straining to get rid of any residue which might block the atomizer. The smell of the kerosene can be masked by adding a little oil of wintergreen or a few drops of amyl acetate.

Flies may be poisoned by the use of sweetened formalin solution. The liquid consists of formalin, sugar, lime water and water in the proportions of six parts commercial formalin, three parts sugar, fifty parts lime water and forty parts water. The trap is a wide-mouthed jar with the opening covered with clean blotting paper kept moist by two strips of blotting paper passing through slits in the cover into the liquid which nearly fills the jar. The flies are attracted to the wet cover over the liquid, sip from the paper and are poisoned. Commonly, such liquids are put out in shallow dishes with a piece of blotting paper or bread placed in each dish for flies to alight on, but in this case the poisoned flies drop into the liquid. The formalin bait is slightly poisonous to humans so the jars or dishes containing it must be kept out of the reach of children.

(d) Screening. The screening of windows and doors to prevent flies from entering houses is much to be preferred to the adopting of measures for trapping them once they have gained entrance. Everyone agrees with the normal practice of screening larders to prevent flies from entering. Similar screen mesh should be permanently fixed over toilet room ventilators. Where practicable, permanent screens can be placed over kitchen and dining room windows which are frequently opened for ventilation and where the odour from food will attract flies. Movable screen frames can readily be constructed for covering windows where permanent screens are not desired. The back door of the dwelling house being in close proximity to the kitchen and larder where food is prepared and stored is likely to admit the majority of flies which enter dwelling houses. Hence any householder really desirous of excluding flies from his dwelling should fix a wire screen-door immediately to the outside of the wooden door. This door should be close fitting, and so hinged that it opens outwards only. To be really effective, it requires to be self closing. Light wire screen doors of this nature may be seen at the entrance to fish-mongers' shops in most towns and there is not the slightest doubt about their being highly efficient. Wire-screen doors are almost a normal fitting in the majority of modern houses in Australia, particularly in the more recently built areas such as Canberra, and although flies are much more numerous there than here it is uncommon to see a fly inside a house so protected. The wire screen cloth for windows or doors should be 14 or 16 mesh and although the more expensive copper screen cloth has a much longer life, the galvanised or lacquered will answer the purpose well. Wire screen cloth is sold in rolls three feet wide and costs about 1/3 per square foot for copper and 9d per square foot for galvanised and lacquered.

Conclusion

For the purposes of disease prevention and for general cleanliness and comfort it is essential that preventive action along the lines indicated in the bulletin should be adopted. The first essential is that **all** persons concerned should take simultaneous and continuous action to clean out the flies' breeding grounds.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

Porina Caterpillars And Their Control By The Use Of Poison Bait

Prepared by the Canterbury Agricultural College, Lincoln.

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Throughout the period of the year from April to August, many pastures in New Zealand are often severely damaged by Porina caterpillars, sometimes termed Subterranean Grass Caterpillars. (The term Porina which has been in general use for some time has unfortunately been replaced by the name Oxycanus). Over the past seven or eight years, for example, pastures in many parts of the South Island have suffered more from attack by Porina than from that by the notorious pasture pest — the grass grub. Since the control method which is to be discussed in this bulletin applies to Porina only and is of no avail against grass grub, it is essential that the insects themselves and the type of damage done by each be readily distinguished.

(a) Grass Grub and Grass Grub Damage:—The grass grub is the immature stage of the brown beetle which normally appears on the wing in large numbers every year during the months of November and December. This grub is easily recognised by its behaviour and appearance. It is a soft, dirty white bodied grub with a firm brown head and attains a length of about ¾ inch when full grown. It lies in the soil, frequently within an inch of the surface, doubled up in the form of a C. The grass grub generally occurs in greatest abundance in light, dry, shingly soils. It spends the whole of its larval life below the surface and feeds on the roots of plants. Where the grub is working in pasture the surface becomes soft and spongy and covered with a layer of dead turf which readily peels off or may even be blown by strong winds. These dead patches vary greatly in size and extent, depending on the numbers of grubs present and their distribution. There is normally little real recovery of grub damaged areas, because the roots have been severed, and if the ground ultimately turns green it is due either to re-seeding or, more likely, to invasion by weeds.

(b) Porina and Porina Damage:—The Porina caterpillar is the immature stage of the fairly large greyish-brown Porina moth which commonly flies in great swarms on mild evenings during the second half of October and the early part of November. The caterpillars, which hatch from eggs scattered by the moths during their flight period, are not easily found in the soil, unless very careful search is made, until about the month of April when they will have reached a length of well over an inch. From that time they grow rapidly, and by the time they are preparing to turn to chrysalides in late August they may measure as much as 2½ inches in length. The Porina caterpillar is a soft, lanky greyish-green creature with the upper surface much darker than the under, and the body very sparsely covered with hairs. If one of these cater-

pillars is held up between the finger and thumb, the soft, flexible body will droop like that of an earthworm. The creature lacks the rigidity of the somewhat similar cutworm caterpillar which has a much stouter body and usually lies in the soil coiled round clock-spring fashion. Porina caterpillars are often found to be more abundant in the fairly heavy types of soil and hence are destructive to the better pastures whereas grass grub is more a pest of the poorer pastures on the lighter soils.

The caterpillar lives in the ground in a vertical burrow which may go down 10 or 12 inches in deep loamy soil. At night it leaves its burrow to graze on top of the ground. Its food consists entirely of the above-ground portions of plants. Hence, where Porina is working the pasture becomes bare in patches; the ground remains firm because the plant roots are left intact, and there are large earth castings thrown up on the bare areas. The firmness of the ground in Porina infested soil is also due in large measure to the behaviour of the caterpillar which remains in its permanent burrow and does not move about through the soil swallowing and pulverising the earth in the manner of the grass grub. Damage occurs chiefly throughout the period April to mid-August. Unless the plants, clovers in particular, have been killed by persistent grazing hard down into the crowns, a considerable amount of recovery takes place later in the year. The important features are that the feed value of the pasture is greatly reduced in the early spring when it is urgently required; a considerable invasion of weeds takes place, and if the pasture is to be closed up for seed production it is likely to produce a much poorer crop.

Precautions Which Might Reduce Porina Infestation

Porina attack seems in the present state of our knowledge to follow no well defined rules. For no very obvious reason one pasture may be infested while another nearby is not. There is, however, a strong probability that the time of shutting up for hay or seed may influence liability of infestation the following year. The adult moths are on the wing in greatest numbers from mid-October to the end of the first week in November. If a paddock is shut up during that period, or if stock happens to be kept off it, then there will be a little more cover for eggs when dropped, and the moths can lay their eggs without being disturbed by stock. When practicable heavy stocking of a valuable pasture during this critical period would appear to be a wise precaution.

Control by Poison Bait and Type of Bait to Use

The poison bait method of control, as universally adopted for other above-ground feeders like armyworms, cutworms and grasshoppers, has proved an efficient and in fact the only known reliable control measure for Porina. Because of its cheapness and ease of application, it is well worth adoption in order to protect a valuable pasture, particularly where abundant feed is required in early spring or where small seeds are to be saved, for the outlay will be insignificant compared with the probable return. A satisfactory poison bait mixture is as follows, and the quantities stated are sufficient to treat one acre:—
1½ pounds Paris Green, 30 pounds bran, 3 gallons water, in which is dissolved a pint of molasses.

If Paris Green ([redacted]) cannot be obtained then lead arsenate powder as used for orchard and horticultural sprays may be substituted for it, but it requires to be used at the rate of 2½ pounds to 30 pounds bran when preparing the bait. The reason for adding molasses

is to sweeten the bait and presumably make it more attractive, and also to prevent the bran particles from drying out too quickly. Actually there is no conclusive proof that molasses does make the bait more attractive, and there is not much likelihood of the bait drying out too quickly while on the ground during the winter months. In consequence it is thought to be advisable to reduce the quantity of molasses to a minimum or leave it out of the mixture altogether because it makes the bait sticky and more difficult to broadcast evenly.

Mixing The Bait

The required quantity of bait is calculated from the total number of acres to be dressed, bearing in mind that one acre requires 1½ pounds Paris Green, 30 pounds bran, approximately 3 gallons water, and 1 pint molasses. A very necessary precaution before mixing the substances is to tie a cloth over the mouth and nose to prevent inhaling the dust, as arsenic is very poisonous. Mix the dry Paris Green and bran thoroughly and on a clean concrete floor if possible. Then add the water gradually and mix thoroughly once more. If molasses is used it should be dissolved in a little hot water and added to the bulk water before this is poured over the dry Paris Green and bran mixture. The wet mixture is now ready for application to the pasture and can be distributed much more evenly and rapidly through a manure distributor than by hand.

When the caterpillars come up to feed at night they find the bait attractive and will readily eat the poisoned bran particles even although the ground is not bare and some grass or clover is still available to them. If possible the bait should be applied during a dry spell as it is not desirable that it should be washed into the soil by rain until a few days afterwards.

Time of Application

Damage to pastures takes place chiefly between April and mid-August. From April onwards a close watch should be kept on valuable pastures so that an application of bait can be made as soon as bare patches with earth castings begin to appear. Application of the bait after most of the damage has been done is of little avail. The caterpillars will have finished feeding about mid-August, hence the bait should be applied during the months of May, June or July, but certainly not later than the end of July.

Danger to Stock

The danger of poisoning stock is practically nil if reasonable care is taken to ensure that no lumps or small heaps of mixture are thrown down and if animals are kept off treated pastures for about a week, or even a shorter period if rain has fallen after treatment. Evidence from countries where similar baits are employed for grasshopper and cutworm control shows that the risk of poisoning small birds through eating poisoned bran particles or through devouring poisoned insects is also very remote.

Experience on the Canterbury Agricultural College Farm in 1942.

Several good pastures on the Canterbury Agricultural College farm were heavily infested with Porina caterpillars in the winter of 1942. Numerous bare patches began to show up in late June. Early in July it could be seen that the damaged areas were spreading at an alarming rate, and when sampling was carried out by digging up square foot blocks throughout the fields, caterpillars were abundant in both the bared and grassed areas. At this time when caterpillars are practically fullgrown there is no difficulty in estimating the numbers present provided enough random soil samples are examined. Past experi-

ence has shown that an average of two caterpillars per square foot (87,120 per acre) or more will cause heavy damage.

A total of about 120 acres was dressed with the Paris Green-bran-molasses bait. The bait was mixed and then applied broadcast by machine. Two types of machine (1) an 8 foot horse-drawn fertiliser distributor with a maximum daily acreage of 12 acres, and (2) a 14 foot motor truck top dresser with a maximum daily acreage of 80 acres on this class of work with all materials ready mixed, were used and both proved very satisfactory for the job. The total cost, including materials, mixing, and applying, worked out at approximately 7/- per acre. (Paris Green 3/- per lb., bran 1d. per lb., molasses 1½d per lb.). Highly satisfactory results were obtained from the treatment. The immediate effect seemed to be that the further eating off of grasses and clovers almost ceased and earth castings were no longer being thrown up. After a few days, rain having fallen in the meantime, large ocks of gulls and other birds were ttracted to feed in those infested paddocks where water tended to lie. Whether the caterpillars were forced to the surface by flooding of their burrows alone or whether the poison had some effect in causing them to remain exposed on the surface is not definitely known. Commencing one week after application, periodic examinations of the bait-treated paddocks were carried out and a heavy mortality among caterpillars was revealed. Dead caterpillars were rarely found on top of the ground and any which died there would be liable to be devoured by birds. Dead caterpillars were found mostly at a depth of 2 to 3 inches below the surface. The number of live, healthy caterpillars found after applying the treatment was not numerous enough to do serious damage. The treated pastures made a good recovery and those closed up at a later date for seed production very soon showed no trace of the attack.

Summary

The Porina caterpillar lives in a vertical burrow in the ground and comes to the surface at night to feed. It must not be confused with the grass grub which is small in comparison, white in colour, and lives constantly below ground level, feeding on roots. Poison bait control is applicable to surface feeders only. The bait recommended per acre is 1½lbs. Paris Green, 30lbs. bran, and 1 pint of molasses in 3 gallons of water, mixed and broadcasted in the months of May, June or July. In the winter of last year 120 acres of infested pasture of the Canterbury Agricultural College farm were treated and satisfactory results obtained. The cost of material and broadcasting averaged 7/- per acre. If best results are to be obtained, it is necessary to broadcast the mixture as soon as the first signs of damage are in evidence.

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ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

LINEN FLAX

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Bulletin No. 14 of this series, published in 1930 was entitled "Linseed Growing as a Sideline." At that time Linseed was grown for seed, for export and for the manufacture of Linseed oil. The fibre varieties had not been introduced to New Zealand. One of the chief recommendations in the bulletin was the growing of the seed of improved strains of linen flax varieties for export to Northern Ireland to be used there for growing for fibre. To test this market the College grew and shipped to Ireland a small consignment of J.W.S. linen flax seed. This seed realised £50 per ton F.O.B.S.I. Lyttelton.

The recent development of a linen flax processing industry with production of fibre for export has been made possible as the result of introduction of mechanical methods of handling the crop.

In New Zealand the first crops of linen flax grown for fibre were produced in the 1939-40 season when an area of about 400 acres was handled. Owing to war time demands the crop has now become one of the important cash crops on the arable land in the South Island and today it ranks next in area to peas and barley. When European supplies of flax were cut off from England, an appeal to the Dominion was made and New Zealand farmers were asked to grow 14,000 acres in 1940-41. This was increased to 25,000 acres in 1942-43 and an equal area in 1943-44. The Agriculture Department has organised the production of this new crop under a system of contract and in the 1942-43 season over 21,000 acres were grown.

The establishment of the industry has been based on a considerable amount of investigational work on the part of the Department of Agriculture and the Agronomy Division of the Department of Scientific and Industrial Research, as a result of which suitable districts and soil types have been determined and suitable methods of growing and handling the crop have been devised.

A secondary industry of some importance has also been built up round the linen flax crop. Flax retting factories have been established in all of the main flax growing districts. The factories produce what is known as line fibre which is exported to England where it is used extensively in the manufacture of aeroplane fabric, canvas, twine rope and linen cloth. Manufacturers have reported favourably on the quality of the New Zealand product.

Kinds and Varieties

Under the contract system the farmer has no say in the choice of the variety to grow. The varieties which are distributed have been selected by the Department for their ability to produce high yields of good quality line fibre under New Zealand conditions. Among those which have given good results are the long strawed varieties which

have been especially bred for fibre purposes, namely J.W.S., Concurrent, Stormont Cirrus, Liral Crown, and Liral Prince. These differ from the shorter strawed linseed types with large seed which have been grown in New Zealand for many years for oil producing seed.

Soil and Climate

Flax can be grown satisfactorily over the climatic range of rainfall and temperature which is experienced in the main wheat and oat growing districts in the South Island. Its requirements as to soil are more precise and the best crops are grown on well drained loams with a good water holding capacity. The crop has a very short growing period and an adequate supply of moisture is necessary right on past the flowering stage. In the drier districts strong loams will produce good crops but when the spring and summer rainfall is above the average, there is a risk of lodging on strong land.

Flax should not be grown on paddocks which are uneven or which are badly drained. Any feature which will tend to cause uneven growth or irregular ripening should be carefully avoided because of the effect of such character in lowering the quality.

Place in Rotation

Flax is a spring sown crop and is a very poor competitor against spring weeds. Many crops have had to be rejected for fibre production on account of a heavy infestation of fathen and therefore one of the first points to consider when selecting a field is its freedom from weeds. Flax may be grown after cleaning crops such as turnips and greenfeed, provided the land is ploughed early enough and given good cultivation before sowing. To control annual weeds preference should be given to land which has been in pasture for several years provided the land is not so strong as to cause lodging.

The old idea commonly held that flax impoverishes the soil more than other crops is now recognised as being incorrect. It is an exhausting crop but not more so than cereals. A second crop of flax is usually poor and this has given rise to the opinion that it is a very exhausting crop, but the lessened yield is probably a result of disease rather than of soil impoverishment.

Cultivation and Sowing

The land should be ploughed in early winter to get the full benefit of frosts and weathering and to permit the development of a firm, even seed bed. All deep work should be completed six weeks before sowing. The last six weeks should be devoted to repeated harrowing and rolling to destroy surface weed seeds and to consolidate the seed bed.

The seed is small and should not be drilled too deeply, hence the need for a firm seed bed. It is usual to drill in September or early October in seven inch rows at the rate of 70 to 80lbs. per acre on medium soils, and up to 100 lbs. per acre on heavy land. The heavier sowing on strong land is necessary to prevent the stalks from growing too coarse and to encourage a tall even growth. Cross drilling causes the stems to be thinner at the intersection than in the rows and the resulting irregularity lowers the quality. After drilling, a stroke with light harrows should be given to level the ground and cover the seed evenly.

Under the fertiliser rationing scheme 1½ cwt. of superphosphate per acre or its equivalent is allowed and this should be drilled with the seed. No other treatment is necessary during the growing period except to remove any tall growing weeds such as docks or thistles. This can be undertaken when the crop is 4 to 6 inches high.

Harvesting

In New Zealand linen flax is either pulled by a flax pulling machine or it is cut with a binder. The binder makes a more even sheaf except in a lodged crop, but it is more wasteful on account of the 2-3 inches of straw which is left as stubble. However, owing to the difficulty of securing rubber belting for the pulling machines, cutting with the binder may be common in the future. Cutting is a tough job for any binder and the knife should be kept sharpened and in good condition.

The crop should be cut when the lower third of the stems have turned yellow and most of the stem leaves have fallen off. At this stage the mature seed bolls will contain ripe seed, while the seed in the green bolls will be milky.

Under normal conditions 10 to 14 days in the stook will dry the straw and the seed. The latter takes longer to dry than the straw. When dry the crop may be carted directly to the flax mill if the mill can handle the produce at once. More commonly it is necessary to stack the crop on the farm. The sheaves must be placed carefully in position and straightened during stacking. The top of the stack should be well covered with thatch or bag cover or with a good depth of straw to prevent excessive weathering of the exposed butts. These precautions are necessary if the full value is to be obtained for straw quality.

Processing of Straw

This does not directly concern the farmer but a knowledge of the manufacture of line fibre will help to show the need for producing straw of high quality.

The first operation is deseeding whereby the seed bolls are removed by special machinery. The seed is later machine dressed and may be used for seed or for the manufacture of linseed oil. The deseeded straw is then packed into retting tanks and covered with water under controlled temperatures. Under these conditions bacteria and fungi which are present on the straw attack the stem tissues which hold the fibres together. This takes about 5 or 6 days and when completed the water is drained off and the straw is spread out to dry. When dry the retted straw is scutched in special machines which complete the separation of the stem tissue from the fibres. The final product is known as line fibre. One ton of straw will on the average produce around 2 cwt. of seed, 2 cwt. of line fibre and 1 cwt. of short fibre or tow. Dew retting is practised at some factories. In this case the straw is spread out in thin layers on grassland for a period of up to six weeks, during which time it is turned periodically. Under the influence of dew and rain bacteria and fungal action attack the stem tissue as in tank retting but the process cannot be controlled so accurately and the quality is poorer.

In the production of fibre the proportion of line fibre to short fibre is influenced by the length of straw, the even packing of the straws in the sheaves, and the amount and degree of weathering of the straw.

Contracts

A farmer who desires to grow linen flax must make application to the Department of Agriculture. The field intended for the crop is inspected and if it is considered suitable the grower enters into a contract with the Department to grow a specified area. At the present time (1943) the value of undeseeded straw, i.e., straw and seed, is £6 per ton for straw 22 inches in length, plus a bonus up to £3 per ton for extra length, fibre quality, and freedom from weeds, disease, and the effects of lodging. There is a further bonus, up to £/1/10/- per ton, which may be paid if the quality and condition after harvesting

has n[illegible]teriorated through the effect[illegible]eathering in stook and stack, [illegible]ing, or vermin, etc. Should any crop be rejected for fibre production, the Department may pay for the crop on a seed production basis at the rate of £20 to £25 per ton of machine dressed seed. The yield of undeseeded straw will on the average range between 1½ and 3½ tons per acre and the yield of seed up to 10 cwt. per acre. If the best quality straw is produced and good yields are obtained, flax growing can be a profitable venture.

Diseases

There are several diseases of linen flax, the most important of which are wilt, rust and browning or straw break. These diseases are mostly seed born, some are soil born, but the severity of the disease is influenced by seasonal conditions. The grower has no effective means of controlling any of them once they have appeared in his crop. A second crop is more prone to severe infection than a first crop sown on healthy ground. The Department of Agriculture is endeavouring to reduce disease by supplying seed which has been produced from nucleus disease free crops.

Summary:

Linen flax is a new crop for the arable farming districts in New Zealand. The crop can be grown satisfactorily and yields between 1 and 4 tons of straw per acre are obtained. Good quality line fibre suitable for export has been produced in the tank retting and dew retting factories. The methods which have been found suitable for growing and harvesting the crop are outlined.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.

ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

Wool—Its Use In Manufacture

Prepared by the Canterbury Agricultural College, Lincoln.

Bulletin CHRISTCHURCH, JUNE, 1943. No. 167.

Wool may be coarse or fine, long stapled or short, and the fibres may be regular throughout their length or they may have weak regions which break during processing. Yet no wool is wasted. The purpose of this bulletin is to draw the attention of farmers and others concerned with wool to the technique of the manufacturer; since to understand how raw wool is converted into fabric will enable us to organise our wool growing industry with the maximum efficiency. Although, on the production side, the clip is limited in both quality and quantity by the environment in which the sheep are run, increased returns can usually be achieved by careful preparation and classing. Attention to detail in the shearing shed means that the manufacturer has to expend the minimum of time and effort in the early stages of processing and is able to offer more per pound to secure each line.

Raw wool may be converted into yarn by two different series of processes—the worsted system and the woollen system of yarn production. The two systems produce yarn of fundamentally different structure. In woollen yarn long fibres form the centre or core, while the shorter fibres point in all directions. Worsted spun material has the short fibres removed, and the longer fibres are all arranged roughly parallel with each other and with the axis of the thread. Woollen yarn, being loosely spun, is soft, fuzzy and relatively irregular, while typical worsted yarns are lustrous, without fuzz, round and tightly spun, lending themselves to fabrics deriving their smart appearance from the clearness of the weave construction, such as men's suitings. Although a given batch of wool may be treated alternatively by either method according to economic factors, the woollen industry uses machinery primarily designed for working short fibred material, while the worsted system uses machinery primarily designed for working long fibred material. The woollen manufacturer frequently blends cotton, reworked wool or silk to produce cheapness or special effects, while the worsted manufacturer uses only new wool and, more recently, artificial fibre. In general, the woollen industry uses cheap raw materials, few processes and produces a low priced product; the worsted industry on the other hand, pays the best prices for its raw material, and employs many different processes to give the utmost in finish and style to a quality product of relatively high price. High class Scotch woollens, such as Harris and Westmoreland tweeds, form an important exception, because they are much more valuable than many worsted materials, while their fibres are longer, and selected or sorted with just as much care.

Finally, while practically all woollen yarn is **woven** into fabrics, the hosiery trade takes the softer and fuller types of worsted yarns, **knitting** them into underclothing, stockings and beach wear.

The distribution of the original raw wool into all these different branches of the wool trade commences when the wool is classed in the wool shed. The wool buyer exercises further discrimination when he chooses only those lots which suit his requirements, and finally the sorter is called upon to group the raw materials into "matchings" which contain only wool of a given quality, length and type. Over the relatively small range of types normally presented to him the skilled sorter is able to distinguish very fine differences by hand and eye. Indeed under the best conditions, a sorter recognises correctly 19 times in 20 a difference in average fibre diameter of less than one ten thousandth of an inch.

Worsted Processes

Virgin wool has been the most

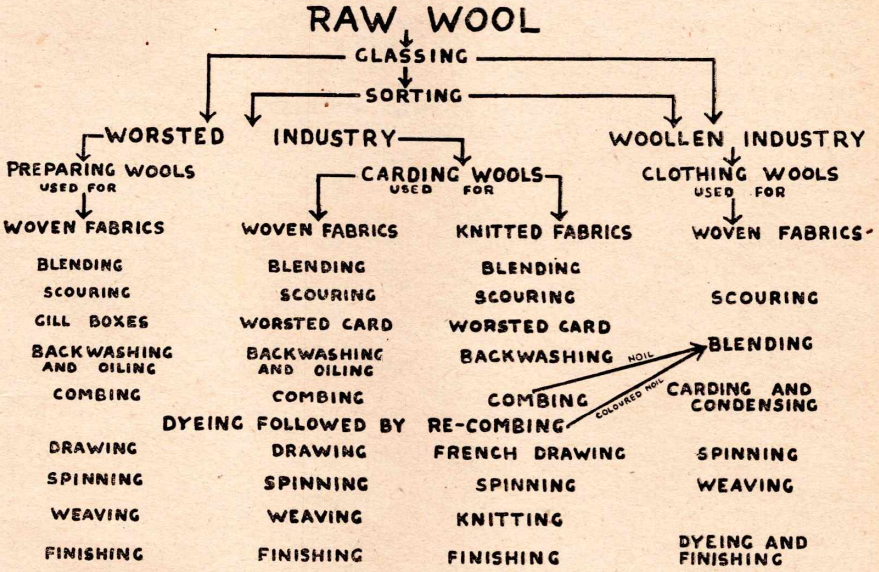
important raw material for the worsted industry until recently, when large quantities of artificial fibres have been brought into the picture. Up to 30 or 40 per cent of this substitute can now be blended into a wool fabric without materially affecting its usefulness to the wearer.

The first process in worsted manufacture is sorting. No two fleeces, even from the same type of sheep and from the same district, are exactly alike in quality, and quality distribution. If the manufacturer were to use the fleece in its original form he could only produce medium or coarse yarns and the resulting cloth would never be of the highest quality. With the better classes of material, the cost of dividing the fleece into its component sorts, or qualities, is compensated for by increased efficiency in spinning, because the wool no longer contains a large range of types and lengths of fibre. A mill manufacturing high quality goods will always make as many sorts as possible to get the full benefit from each fleece. Mills running on lower grades of goods may make only two sorts by throwing out the edges of the fleece and the britch wool. It is interesting to note that in the United States where labour costs are higher, sorting is often performed very roughly, if at all; the spinner, being satisfied not to spin to the maximum, cuts down the effective price of his raw material.

Actually, although sorting is guided by the requirements of each trade and each manufacturer, and differs according to the type of yarn and cloth produced, certain general principles underlie the distinctions which are made. After eliminating burry wools for carbonising, badly stained wool and wool containing coloured fibre, the two major factors taken into account by the wool sorter in making his subdivision are fineness and length of staple. Fineness is generally specified by the wool sorter in terms of spinning ability, and is expressed most generally in terms of Bradford Count. The "count" is determined by the number of standard hanks, each 560 yards long which can be spun from one pound of combed top. The finer the fibres the more hanks which can be spun per pound. If one pound is drawn out to fifty hanks of 560 yards, such a wool is called a 50s and so on. Obviously, short fibred material will not spin to the maximum count given by its fineness, but 1lb. of 70s quality Merino wool of good staple length, will spin 22¼ miles of yarn per pound. While the count represents the ultimate limit to which any particular wool could be extended, trade practice seldom demands the extreme, and it is now gradually becoming more usual to use count solely as an index of mean fibre fineness. Normally, only even-number counts are recognised, because in practice, this is the limit of accurate judgment by the human eye. It is usual to speak of the intermediate wools as "44/46s" and so on, meaning that the wool is judged to be between 44s and 46s in fineness. Wool men often use the intermediate counts to indicate the bulk quality of a line. Thus a bale described as 50/48s would contain both 50s and 48s wools, with the former predominating. 50s wool is spoken of as "one count finer" than 48s wool.

Although fineness is of fundamental importance, since it is largely upon this feature that the character of the fabric will ultimately depend, length, or effective length in the case of fibres which are weak, determines the method by which they will be processed and the part they will play in cloth construction. After the shortest stapled materials have been separated off by the worsted manufacturer for re-sale to the woollen industry, the sorter will make two main divisions in each fineness group according to length of staple. In crossbred wools, which are of main interest to New Zealand, these two divisions are "Carding" and "Preparing," according to the process which they will undergo prior to combing. Actually, there is no sharp distinction between the two groups but the border line usually made is at about 7in. length of staple for wool of 46s quality. Wools shorter than this are **carded** while the longer stapled materials are **prepared.** Although it has been stated that wools longer than about 9-10in. cannot economically be carded owing to fibre breakage, the loss in efficiency for many purposes is not great. Once the long and short wools have been collected together in sorts or matchings, whether they are carded or prepared will depend more on economic factors and on the machinery actually available. The finer Merino wools are all of a length suitable for carding and are divided by the wool sorter on length into warp and weft, the warp matchings containing the longer and sounder material.

While the wool is being sorted any bulky extraneous material, and stained or coloured wool, as well as remnants of paint or tar brands are removed. It has been established that even the best branding materials are not easily scoured out satisfactorily, and if fragments of brand cling to the fibres as far as the later stages in processing, the colour spreads under the influence of heat, and may spoil a large amount of cloth.



The above table illustrates the most usual order of the processes used in the different systems of cloth production. It is not possible to describe all of these processes in detail in a bulletin of this size, but most of the terms are self explanatory and for further information the reader is referred to the excellent texts which can be obtained through the interloan service of any reference library.

Certain processes, however, require some mention here because their efficiency depends on features present in the raw material. Thus the main difference between the woollen and worsted systems lies in the combing which, in the latter, straightens the fibres and removes the shorter material as "noil." This short fibre would interfere with the smooth spinning of a worsted yarn and is sold to be used in the woollen industry. Wools containing weak or broken fibres, much short fibre, and second cuts give a low ratio of top to noil, and hence are not so economically combed as sound wools. Demand for tender wools is usually poor and the price paid is lower.

The "combed top," as the longer material is called, passes through many drawing and mixing processes before the final spinning. During these operations the sliver, or rope of wool, is oiled and twisted very slightly to control the movement of the fibres as they slip over each other in drawing or stretching. Control of the fibres is very important at this stage, for without control thin places will develop, ultimately, in the yarn. For most efficient working of the machinery used, the difference in length between the longest and shortest fibres must be kept small. If long and short fibres are present in the raw material, the machines cannot be set to maintain control of the shorter fibres without stretching and breaking the longer ones.

Typical worsted cloths are bunting, gaberdine, Palm Beach Cloth, poplin, serge, suiting, tropical worsted, voile, and wool crepe.

Hosiery Manufacture

Since the tensions applied to the threads during knitting are much less than those found in ordinary looms, yarns intended for the hosiery trade may be spun with much less twist than other worsted yarns. The resulting fabric derives much of its strength from the way the fibres themselves are interlaced into the loops of the cloth. For this rea-

son knitwear does not hold its shape indefinitely unless treated with care. At the same time the elastic nature of the looped stitch, coupled with the elastic wool fibre makes knitwear very suitable for close fitting garments such as underwear, stockings and swim suits. These properties are enhanced by the very small changes in texture which wool suffers when wet, and by its high moisture absorbing ability.

An important stage of the hosiery finishing routine takes the form of one of several anti-shrink treatments. Shrinkage consequent on felting is easily the greatest drawback to the use of wool for fabrics which must often be laundered, such as knitted socks and underwear. Needless to say, scientists have devoted a great deal of effort to the discovery of the factors which bring about shrinkage in wool goods. As a result, treatments have been devised which extend the useful life of many garments by at least 100 per cent. Their researches, too, are able to tell us how shrinkage during washing can be kept to a minimum. High temperatures, cheap soaps, and vigorous agitation must never be permitted. The fabric should never be rubbed or wrung as the friction causes felting to take place. For valuable garments thick suds of mild soap should be squeezed through at luke warm temperatures. Two rinse waters of about the same temperature should follow and excess water should be squeezed out or absorbed in a towel. If possible, the garment should be dried flat, or stretched to the original shape on a frame, for hanging while wet will cause stretching and loss of shape.

The Woollen Industry

Raw materials for the woollen industry consist of the shorter types of raw wool ("clothing wools"), noils (shorter fibres removed by combing from materials used in the worsted trade) as well as large quantities of reworked wool, cotton, and artificial fibre. After scouring, the raw wool is treated to remove vegetable impurities. In the lower class woollen materials (e.g. men's very cheap overcoating and cheap blankets) only sufficient raw wool is used to make the fibres hang together during spinning.

In woollen materials, in general, not a great deal of care is put into weaving, and the cloth is said to be "made in the finishing." According to their character, weave and weight, fabrics are divided into "clear finish" and "face finish." Clear finish goods are those which receive little subsequent treatment and consequently show the weave design prominently. The worsted fabrics discussed in an earlier section fall into this class. Face finished goods are those which are so treated that the construction of the cloth is not visible. Broadcloth and meltons belong to this class as well as those woollens which contain cotton yarn.

Typical "woollen" fabrics are:— Flannels, billiard cloths, beavers, blankets and rugs, broadcloths, doeskin, woven felts, meltons, tweeds and velours.

Conclusion

This bulletin is to be regarded as an introduction. In further publications the use of New Zealand's main wool types will be described and the bearing on sheep management policy emphasised. In order to secure maximum returns from wool, however, it is clear that:—

(1) Second cuts, locks and other short fibre materials should be kept out of the main lines of fleece wool, because they decrease the proportion of top to noil in combing.

(2) Skirting must be carefully carried out, because the present tendency towards less intensive sorting requires fleeces with the minimum of off-type material.

(3) All staples having traces of branding fluid should be removed while the fleece is being skirted; pigmented material should not be mixed with pieces, locks, etc., as it requires special treatment to remove the hardened brand.

(4) Small amounts of fibrous material of vegetable origin, such as string and pieces of flax or jute, should be kept out of the clip, because they are not easily removed and must be picked out by hand from the finished cloth.

(5) Broken, tender and cotted fleeces should be kept in separate lines, because they require different machinery in manufacture.

(6) The clip must be presented to the buyer or appraiser in lines which are as even as possible; this enables the wool to be utilised with the minimum of handling in the mill.

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ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

PEAS

Replacing Bulletin 108.
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Peas are used extensively for human consumption and stock feed. As a fodder, crushed peas are useful for show stock, for young growing animals, for milking cows and for pigs. The straw has a considerable feeding value and can be economically utilised by cattle or sheep. The crop is a leguminous one and as such does not draw on the soil for its nitrogen, but actually enriches the soil in this valuable substance. It is a somewhat unreliable crop owing to its dependence on favourable weather conditions during growth and particularly during harvesting. With the advent of the header harvester, however, pea harvesting is more dependable and less costly than it used to be when the crop had to be cut and stacked prior to threshing.

Kinds and Varieties

Peas may be classified into garden and field peas.

1. Garden Peas. A large number of varieties have been grown in New Zealand and their relative importance depends mainly on productivity and adaptability. The most popular at the present time are Greenfeast, William Massey, Onward, and Stratagem.

(a) Greenfeast, also known as Lincoln, is perhaps the most widely grown variety, due no doubt to its hardness, heavy yield and wide adaptability. It is a mid season type growing to a height of about 3ft. and maturing in from 24 to 29 weeks. The foliage is abundant and medium to dark green in colour. The pods are of medium length, curved and narrow but are usually plump and well filled, often containing as many as ten dark green peas of medium size. The seed is somewhat small, wrinkled, almost square in shape and in colour invariably shows a slight admixture of green with cream.

(b) William Massey is the local name for Kelvedon Wonder and is an excellent early variety requiring from 20 to 26 weeks to reach maturity. Like Greenfeast it has a wide range of adaptability but its yield, generally, is not as good; the two varieties, however, sown at one time form an excellent combination for garden purposes, William Massey being ready to pick before Greenfeast. It grows to a height of about 2ft. 3in. and the foliage is medium to dark green in colour but is less abundant than that of Greenfeast. The pods are straight with a rounded end, of medium size and contain up to 8 peas. The seed is wrinkled, tends to be small and somewhat square and is of a medium green colour.

(c) Onward, also known as Southern Cross, is a comparatively recent introduction. It is a mid season variety taking from 24 to 29 weeks to mature and under suitable conditions of soil and climate, gives high yields. It grows to a height of from 2ft. to 3ft. 6ins. and possesses robust foliage which is medium to pale green in colour. The pods are straight, broad, puffy and blunt ended and contain up to 8 large, dark green peas excellent for cooking purposes. The seed also is large, wrinkled and greyish green in colour.

(d) Stratagem, with which may be associated Dwarf Defiance, is a high quality late variety taking 28 to 30 weeks to mature. It grows to a height of about 3ft. 6ins. and on heavy land can be expected to give high yields. The foliage is robust and dark green in colour. The pods are large and straight with a rounded end and contain 7-8 large dark green peas which are ideal for culinary purposes. The seed is large, wrinkled, somewhat flat in shape and of a medium to greyish green colour.

Other varieties of some importance but of less significance are Yorkshire Hero or Greatcrop, a mid season type and Little Marvel and Blue Bantam, two dwarf earlies.

2. Field Peas

(a) Partridge: This is the highest

yielding pea on medium to good land. It is not a suitable variety for heavy land where in wet seasons it produces a large bulk of leafage but little seed. The seed has a mottled brown skin and the flesh is yellow. In New Zealand it is used for split peas and for stock feed. In England it is used almost entirely for feeding pigeons.

(b) White Splitting Peas: White peas have white skin and yellow flesh and are used largely for soups. In New Zealand two varieties are grown for export, namely White Ivory and Victoria. White Ivory is more dwarf and is a smaller pea than Victoria but yields of seed are higher. Both varieties are less vigorous growers and yield less than Partridge but can be grown on stronger land. They have been successfully grown as cover crops for spring sown clover and lucerne stands. A new variety known as White Prolific has been bred by the Agronomy Division of the Department of Scientific and Industrial Research. This variety gives considerably better yields than White Ivory and promises to be a useful crop to grow for high quality split peas.

(c) Blue Boiling Peas: These peas were at one time imported by English merchants from Poland and Japan and were used extensively for stock feeding and as a second class boiling pea. There is now a big local demand for blue boiling peas for Army purposes. The main variety is the Blue Prussian which is a good yielding variety with blue green flesh. The seeds are small and not very sweet when boiled. The Agronomy Division of the Scientific and Industrial Research Department has bred a new variety of blue boiling pea which is called Mammoth Blue. The crop has similar growth characters as Prussian Blue but the pods are larger and the seed is bigger. It is a definite improvement on Prussian Blue in that it tends to give higher yields and produces larger and more attractive seeds. It is being distributed under certification by the Department of Agriculture.

(d) Marrow Fat Peas: These are a class of boiling pea. The seeds are large, green and wrinkled. As a vegetable they are sweeter and more like garden peas than the blue boiling pea. They are retailed as canned peas or as dry peas in packets. After soaking in water with a pinch of soda they are used as a substitute for green peas. Harrison Glory and Imperial Blue are two varieties grown in New Zealand.

Soil Conditions

Peas exhibit a marked response to soil and seasonal conditions. If these are satisfactory the crop yields heavily; if unfavourable, yields may be extremely disappointing. This is particularly true of garden pea varieties, and there is consequently a greater element of risk in growing garden peas than in the growing of field peas. In all cases, therefore, the grower is likely to be well repaid for thorough preparation of the land and careful selection of areas suitable for the crop. Drainage is an important consideration because seed may fail to germinate in badly drained soil if a cold and wet spring is experienced. Moreover, there is a great risk of serious loss as the result of infection from root rots. Peas grow best in a moist, fertile soil and dry atmospheric conditions, though hot, drying winds during flowering will scorch the flowers and reduce yields. Under humid conditions the crop grows too much top and continues flowering over a long season. This applies particularly to the Partridge variety which for this reason is usually grown on lighter soils.

Peas form a valuable crop in the rotation, especially in preparation for a cereal crop and in assisting to maintain soil fertility.

Cultivation and Sowing

Peas like a stale furrow. The land should be ploughed, worked and left lying for some time before the peas are sown. Land ploughed in the early winter should not be reploughed but the surface should be worked as required and the mellow soil left on top. Sowing should be delayed till the soil is warm enough to ensure rapid germination. Apart from this, however, the seed should be sown as early as possible in order to give the crop a long period of growth. This is a particularly important matter in late maturing varieties, such as Partridge. October and November covers the main sowing period.

Garden peas, being wrinkled, and in some varieties very large, do not run freely in the drill, and the use of a force feed is frequently the cause of seed injury. Special adjustments of the modern grain drills are necessary to sow the large seeded garden varieties. Spoon feed drills are particularly suitable for peas and should be used when available. Commercial crops are sown almost invariably through every coulter of a 7 inch drill at the rate of 3 to 3½ bushels of seed per acre. In the

case of some large seeded varieties four bushels per acre is not excessive, although such heavy sowings are probably found necessary to offset seed damaged by the drill and to produce a thick stand. Where birds, particularly pigeons, are troublesome seed should be sown up to 2½ inches deep. It is then more difficult for the plant to be dislodged and if only the tip of the shoot is damaged by birds lateral buds will develop.

If the soil is fine and dry and heavy rain is experienced following sowing or if the ground is cold, germination may be seriously affected. If rain threatens sowing should be postponed. The best germination is attained by sowing in warm, moist, friable soil. Unseasonable frosts will not materially affect the crop except during flowering when the flower buds and young pods are liable to injury.

The ground should be harrowed both before and after germination of the seed. If the crop is very weedy, harrowing with a slow-moving team or pneumatic tyred tractor may be continued until the peas begin "to run." In the case of garden peas rolling sometimes follows. Rolling is, however, not advocated except in the event of the land being rough on top when the header will pick up clods and give a dirty sample.

The use of one to two hundredweight of reverted super is recommended, and larger quantities can be used when the soil is moist and in districts of good rainfall. On some soils application of superphosphate and organic manures, such as blood and bone, injuriously affect the germinating seed.

Rogueing

To meet the requirements of overseas markets, garden pea varieties must attain a very high standard of purity. This necessitates great care in handling the crop, particularly during threshing and machine dressing. Moreover in garden pea varieties, plants arise which are distinct from the parent variety. Some have the appearance of a wild pea, others vary in shape and colour of the pod or in the height of the plant. Off-type plants, whether originating from other varieties or arising spontaneously in a pure variety, are termed "rogues" and the greatest care should be taken to have them removed. For this work merchants who are growing peas on contract sometimes employ gangs of men who are trained to detect at a glance any plant that is not true to type. These men work up and down through the crop pulling out the rogues and by this means a high standard of purity is attained.

Harvesting

Garden peas are usually cut with a mower when the top pods have filled and are just past the ideal stage for picking as green peas. At this stage the crop is beginning to lose its green colour. The object of early cutting is to prevent loss from shattering and to obtain well wrinkled nicely coloured seed. It is usual to fit pea lifters to the mower. The cut crop is left to dry in the swath or wind row for a week or ten days and is then threshed from the paddock with a header. The crop may be carted to a stationary mill or it may be stacked, but growers generally try to avoid the additional expense and prefer to thresh direct from the paddock. Under certain conditions direct heading of garden peas has been practised but the sample is usually not up to best quality.

Field peas, particularly Partridge, are allowed to become dead ripe before being harvested. In the case of Blue Prussian and White Ivories allowing the seed to become dead ripe may not be the best practice, but it becomes necessary when using modern methods of harvesting. The bulk of material, especially in the case of Partridge, renders handling very costly and the introduction of the header harvester has been the means of reducing very materially the cost of production.

Marketing and Quality

Most of the peas produced in New Zealand are exported by merchants who arrange contracts with farmers to grow certain varieties of garden and field peas. Some are grown free and the risks accepted. The area and price fluctuate in response to overseas demands as well as to local conditions. Partridge peas and Blue Prussian which are also used locally for stock feed are often grown free and a reasonably safe market is assured.

Garden peas are carefully machine-dressed and often hand-picked before being marketed. As a rule Partridge peas are not machine-dressed, the cost being hardly warranted. Each year, standards are made up for Partridge peas by the Canterbury Chamber of Commerce and forwarded to the London Corn Trade Association for approval and adoption as a basis of trade between New Zealand sellers and

overseas buyers. Samples of New Zealand peas reaching this standard for export are graded as Maple Peas No. 1. Other lines have to be sold as under grade peas. No. 1 standard is fairly high and in unfavourable seasons its attainment is not often achieved.

Disease and Seed Treatment

Several diseases collectively known as root rots affect the root and stem near the soil surface and may cause serious loss. Affected parts of the stem turn dark in colour and the plants become stunted and yellow. Affected plants are not necessarily killed but remain stunted, yellow, and unproductive. Evidence of infection is to be found in nearly all crops, but severe infection generally originates in localised patches, usually those that are badly drained, and may spread throughout the crop. The disease is usually more severe in a second crop of peas.

Every endeavour should be directed to the maintenance of plant vigour by creating conditions conducive to healthy growth. Rotation, thorough drainage and preparation of the land, and the use of sound, clean seed sown in soil that is warm enough to promote rapid germination, are important factors in ensuring vigorous and healthy growth.

Seed treatment is also extremely useful and is strongly recommended. Several mercurial, red copper oxide, and special pea dusts are available. The effect of these is to stimulate establishment to a very marked degree and to reduce the risk of disease. Garden peas are particularly prone to rot if the seed is not in the best condition and the soil is damp and cold. Under such circumstances these dusts have a marked beneficial effect on germination. On the other hand if seed is sound and soil conditions are favourable the dusts have little advantage. Since it is impossible to predict the conditions at and subsequent to germination it is wise to insure against the effect of unfavourable conditions by dusting all garden pea seed before sowing.

Feeding to Stock

Peas may be fed to stock either as a standing crop or after cutting and stacking; alternatively, the threshed grain and straw may both be used to form part of the rations for stock. On account of the risk of nutritional disorders, pea straw should be fed sparingly to horses and cattle. Peas may also be grown with oats to produce a valuable hay crop.

The crop may be fed to lambs, as a substitute for rape where the latter is likely to fail, or to pigs. The feeding off is usually done when the peas are ripe or nearly so. As a substitute for rape the peas are sown in early October and in a favourable season should be ready for feeding when the first pods are full, about January. Because they are more palatable, White Ivory or a wrinkled variety of peas such as Yorkshire Hero is favoured in preference to Partridge for a feeding off crop, although the cost of the seed is higher. Care must be taken when feeding off ripe peas with lambs to see that they are not allowed to gorge themselves, otherwise digestive troubles will be set up. Where satisfactory rape crops for fattening can be grown, peas cannot compete with them on account of the higher cost of seed.

If peas are sown with some more upright growing crop, e.g., rape or kale, the wastage, which otherwise may be excessive, is reduced. For feeding later in the season to pigs or hoggets, the kale and pea combination is a useful crop and should be sown in early summer.

On farms where pigs are wintered, peas cut when ripe and stacked can be fed unthreshed to the pigs and are an excellent supplement to roots. They might also be fed to sheep, but in wet weather they should be fed from racks to avoid wastage.

When threshed both the grain and straw make useful stock feeds. The straw provides a maintenance ration only and can be fed to best advantage early in the winter period while good hay is kept for the late winter or early spring period. For sheep-feeding the grain may be fed whole or cracked. It is a particularly valuable supplement for feeding during the latter stages of pregnancy. For ewes ¼lb. per day in association with good hay or oat-sheaf chaff should be fed for the month prior to lambing. The grain also forms a useful component of rations designed for show sheep or for winter hoggets. For horses, cattle, or pigs the peas are better crushed.

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MOLE DRAINAGE

Prepared by the Canterbury Agricultural College, Lincoln.

Bulletin CHRISTCHURCH, AUGUST, 1943. No. 169.

There are many areas in N.Z. where through inadequate drainage of the soil seasonal cultivation is hampered, stocking is restricted, pastures are inferior and production is reduced. These effects are the result of waterlogging of the subsoil and often of the surface soil. Every soil has a certain water holding capacity, and any water in excess of this is termed **free** in that it can be drained off. This free water occupies the spaces between the soil particles thereby excluding air from the plant roots and tending to cause the development of stagnant conditions. Crops and pastures are restricted in root growth to that zone of the soil which is above the free water level.

Soils may be divided into three main groups according to the position of the water level:—

(1) Where the water remains permanently at or near the surface, swampy conditions prevail and the subsoil clay is usually greenish-blue in colour.

(2) Where the free water level is permanently at a depth greater than three feet, the soils are well drained and the subsoil clay is a uniform yellow to brown.

(3) Where the free water level fluctuates seasonally over a range of depths varying from more than three feet to within a few inches of the surface, soils have seasonally-impeded drainage and the subsoil is mottled with uneven patches and streaks of yellow, bluish-grey and rusty brown. This class often has an iron pan (hard pan) or a band containing ironstone pellets a few inches below the gradation of surface soil into subsoil. Until the drainage is improved the agricultural use of these soils is restricted.

It is with the soils with mottled clay subsoils and seasonally impeded drainage that this bulletin deals.

Soils Suitable for Mole Drainage

The mole drain is simply a tunnel formed in the soil at a depth of from 14 to 30 inches by the passage through it of a torpedo-shaped metal plug attached to the end of a rigid knife blade.

Since the mole is dependent for its stability on the cohesion of the compressed material, only soils with a fairly uniform clay subsoil free from silty or sandy bands can be effectively drained.

Mole drainage is of more recent development than other types of drainage and it is more restricted in application than is either the open drain or the tile drain. In suitable soils moles are as effective as tiles, and have the advantage of ease of installation and much lower costs.

Mole Drainage in New Zealand

The first mole drainage in this country was undertaken in Southland, the results being so satisfactory that regular mole draining is now a standard practice. At a later date it was practised in various sections of the North Island and in recent years, to a very limited extent, in Canterbury. In the early days the ploughs were drawn by horses or bullocks and later by cables operated from steam engines. Now practically all haulage is done by tractors. There are several types of mole plough but they vary mainly in details of adjustment. Prices range from about £20 upwards.

Land suitable for mole draining occurs in many districts. In Canterbury there are extensive areas on the Moeraki Downs, along the foothills, and on the rolling country of South Canterbury. These, together with isolated small areas along the coast would benefit markedly from mole drainage.

Action of Mole Drains

The knife blade of the plough cuts a slit from the soil surface down to the torpedo which opens the mole. The passage of the blade and the torpedo heaves up the soil slightly for a distance of one to two feet on each side and opens up cracks and fractures throughout this area. The primary cut and the secondary fractures tend to open out as the soil dries and to close up as it is wetted. The closing is never quite so complete as to seal off the moles. Free water, which accumulates in the more permeable surface soil, tends to soak down to the "plough sole" or to the boundary between surface soil and subsoil and then flows along this junction until it reaches the permeable area round the blade slits. It then moves down to the mole.

Preparation of Land

Moles are always made when the land is under pasture. The frame of the plough rides on the surface and the depth of working is adjusted by the dip of the torpedo and by the length of the knife blade. This means that since mole ploughs tend to follow the surface of the soil the mole, too, is subject to any rise and fall occasioned by surface irregularities, It is therefore advisable to use a long draw-chain.

Very wet paddocks may require an initial rough drainage scheme which should function sufficiently well to permit the preparatory work necessary for a second and more thorough installation. Wherever possible it is advantageous to do some preliminary levelling on paddocks showing irregularities such as finishes, feerings, hollows, or hummocks.

Another important preparatory operation is the design or layout of the installation. This is determined mainly by the available fall, the location of the major outlets, the topography of the area and the presence or absence of pockets or ironstone. There is a close connexion between the fall and the scouring and silting of moles. In general, where fall is very slight, e.g., 1 in 200, the more carefully the ground surface is levelled, the more efficient is the mole. Where fall is moderate, e.g. 1 in 40, surface irregularities are not serious, while excess fall, e.g., 1 in 10, may result in scouring. As a guide moles should be given a fall within the range of 1 in 80 to 1 in 20.

Simple devices for the taking of levels can be made, but in the majority of cases farmers would be advised to get a surveyor to prepare a simple plan giving contours or levels at set intervals. This is very necessary where the fall is slight and the operator is not experienced in mole draining.

The location of the mole outlets is important and this is considered later.

Time for Mole Draining

Moles may be drawn at any time the soil is sufficiently moist to permit ready passage of the torpedo and result in a smooth wall to the channel. Moles tend to break down rather rapidly if heavy rain falls shortly after pulling. There is evidence to suggest that moles tend to hold better if dry weather follows their installation, and this is most likely to occur in the late spring when mole draining is recommended.

Depth and Diameter of Moles

The best depth for moles is determined by the nature of the subsoil. The most stable moles are those drawn in the heaviest clay zone and this is most frequently found at a depth from 18 to 24 inches from the surface and about 2-4 inches below the layer containing the ironstone pellets. A simple way to test the subsoil clay is to open a flat face of soil to a depth of 30 inches and then to test with a knife the density and compactness of the clay.

The diameter of the mole is determined by the diameter of the torpedo and the attached plug. Plugs in regular use range in diameter from 2½ to 4 inches. The most general practice is to use 4 inch majors to act as collectors from several minors and to use 2½ or 3 inch moles for ordinary single minors.

Distance Between Moles and Length of Moles

The spacing of moles is determined both by the nature of the soil and the amount of water to be removed. In the heavier rainfall districts of the North Island moles are usually from 6 to 9 feet apart whereas in Canterbury and Southland the moles are frequently 9 to 15 feet apart. The closer the drains the more rapidly excess water is drained off and the less important are the failures of single moles.

The longer the drain the more danger there is from blocking al-

though this is reduced if the fall is even and good. No fixed length can be given for the length of a drain but the following are the recommendations made in the publication mentioned at the end of this bulletin.

(1) When the fall is less than 1 in 50 individual drains should not be more than 3 to 5 chains in length and not more than 15 to 20 chains should be connected to one major.

(2) When the fall is greater than 1 in 50, individual drains may be as long as 25 to 30 chains although 5 to 10 chains is preferable. The total length of drains connected to one major should not exceed 30 chains.

Life of Mole Drains

The length of time over which moles will remain effective depends on many factors, the most important being the amount and uniformity of fall, the physical nature and condition of the soil at the time of drawing and the weather conditions for the first few months after drawing. Moles drawn under the best conditions have been known to last for more than 30 years, but this is exceptional. The average life of a mole drain system—i.e. the length of time it remains effective in removing free water—is from 3 to 6 years though deterioration takes place steadily after the first season. This means that moles must be redrawn on the same field every few years and the only reliable guide to the time when remoling is necessary is provided by the condition of the field following heavy rain.

The main causes of breakdown are loss of fall, blocking of the channel and neglect of the outlets. Loss of fall is usually produced by surface irregularities at the time of drawing and by the slowing up of the rate of flow through backing-up from overloaded majors or weed choked outlets. Blockages may result from the collapse of the roof at the point of contact with the blade slit, silting from sediments washed in with the drainage water, or from breakdown of the channel walls where the mole passes through bands of silt, sand or ironstone.

The effectiveness of moles is very dependent upon the provision of suitable outlets. These must have freedom of discharge and be protected against scouring and blocking. Moles are usually discharged through tiled outlets.

Systems of Mole Drainage

Mole drains may be used in conjunction with tiles or open drains or they may be used alone in which case the outflow is usually collected from minor moles into major moles drawn with a torpedo and plug of larger diameter.

Where moles form a secondary system associated with either open drains or with tiles the moles are drawn away from the outlet. This means that the moles are drawn only on the outward trip but time lost in returning "empty" is more than compensated for by that gained in reducing the time that would otherwise be required for connecting moles to the outlet point. These combined systems are specially adapted to flat land with a slight fall in one direction.

Where moles are led into open ditches the end of the mole should discharge through a tile. With combined systems of tile and mole drains the moles are usually led into the trench about three inches above the tiles and discharge into the permeable layer of shingle, turf or brushwood directly covering the tiles. Where the whole system is made up of moles each mole may have its own outlet in an open drain or on the side of a gully or a series may be made to discharge into specially drawn collecting major moles. In the former case pulling can be done in only one direction, that is, away from the outlet. It is suitable either for land with a slight fall in one direction or for rolling country, although here the large number of outlets involves much upkeep.

The connection of many minor moles to a major mole and of one or two majors to a tiled outlet greatly reduces the number of outlets required and makes possible the selection of the best locations. Such a system can be adapted to a variety of conditions of topography and since the majors are drawn after the minors the drawing of the latter may be done on both the outward and return trips of the tractor thereby reducing operating time.

Joining of Moles

The joining of moles requires considerable care and thorough workmanship to ensure that the channels are free and that fall is maintained. Minors should enter majors at an angle of about 45 degrees though junctions at less acute angles up to 70 degrees are more readily made

and function satisfactorily when done well. The union may be made in a number of different ways and the majors may be drawn either at the same depth as the minors or 2 to 3 inches below them.

In either case a rectangular hole must be opened to the depth of the minor about 4 inches on the lower side of the minor at the intersection of the major and minor. A special universal jointed auger is then used to remove any soil squeezed into the minor by the passage of the plug when the intersecting major is drawn. When the union of minor to major is clear a plug of plastic clay is inserted on the blind side of the minor to prevent seepage and the hole is refilled. Slight modifications of this method of joining have been introduced to make possible the joining of minors to majors pulled at a lower level. This method of joining moles is time and labour consuming but it must be stressed that no alternative method is as reliable.

Cost of Mole Draining

The cost of mole draining varies with topography, the amount of preparatory work required, the depth of working, frequency of moles, equipment used, nature of outlets and effective life of the installation. Contractors charge about 30/- per acre for an average installation and this is exclusive of levelling, the joining of minors to majors and the provision of outlets. Farmers using their own equipment may reduce the per acre cost well below this figure for simple installations. Even under the most difficult conditions the per acre cost of installing and maintaining a mole drainage system is but a fraction of that which adequate tile drainage would cost. On land that is affected by seasonally bad drainage and which is suitable for moles, this method of removing free water must be regarded as both effective and inexpensive.

Summary

Soils with a dense clay subsoil which are subject to a fluctuating water table with waterlogging of the topsoil at certain seasons of the year are unsuitable for the best growth of pastures and crops. Cultivation is hindered, farming programmes upset and stocking of pastures is restricted. Such soils must be drained before their potential productive capacity can be realised. Soils which are in this category and are suitable for mole draining can be improved to a remarkable extent.

Mole drains are drawn with a mole plough at a depth of 18 to 24 inches usually during late spring on pasture land. An even fall in the mole is necessary and this makes the removal of surface irregularities advisable, especially on land where the fall is slight. The efficiency of a system of moles is dependent upon the maintenance of a regular and limited fall and a preliminary survey of the field is usually advisable. This should be used as a basis for the design of the whole layout.

The mole drain is simply a tunnel drawn in the subsoil clay and its stability is affected by many factors. The life of a system of moles may vary from a few months to many years but an average life is about 5 years. The costs of installation are also variable but an average installation may cost from 10/- per acre for the simplest and most straightforward type to £3 or more for very complex systems. On a per acre basis the annual cost of installation and maintenance is low by comparison with alternative methods of drainage.

Much of the information contained in this bulletin has been abstracted from a very complete and valuable review of "Mole Drainage in N.Z.," by A. W. Hudson and H. G. Hopewell published as Bulletin No. 86 by the Department of Scientific and Industrial Research. Information additional to that given in the foregoing bulletin is furnished in the publication mentioned.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.

ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE

AGRICULTURAL BULLETIN

POTATO GROWING

Prepared by the Canterbury Agricultural College, Lincoln.

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In the past season (1942-43) about 21,000 acres of potatoes were grown in New Zealand and a fifty per cent increased area of 33,000 is asked for the 1943-44 season. The production of a crop of potatoes requires a considerable amount of labour and the expected acreage can only be achieved if full use is made of machinery in planting and harvesting the crop. It will also be necessary to make full use of the available supplies of "seed" potatoes. It has been the custom to plant "seed" of an average size of 2½ to 3 ounces but smaller "seed" than this will have to be planted. Some growers will have to cut their seed and provided each piece has one or two strong sprouts or eyes and sufficient weight of the tuber to give the plant a good start, good crops can be expected from cut seed. The seed should be "cut" immediately prior to planting to reduce losses from rotting in the ground. Cutting sprouted and greened seed is more reliable than cutting unsprouted seed.

There are numerous varieties to choose from but for general purposes the choice can be narrowed down to some five or six varieties which have proved suitable for New Zealand conditions. The most popular variety is Aucklander Short Top followed by Dakota and Arran Chief; King Edward VII and Inverness Favourite are good yielders and Arran Banner is also worth attention. The early varieties, such as Epicure, Jersey Bennes, etc., are low yielders and do not play an important part in providing for the total requirements of the Forces or the Dominion.

Soils and Climate

The most suitable soils for potatoes are free working medium loams, deep sandy loams, light silts or light peaty soils. Shallow soils are not as a rule good. Stiff, heavy clay soils are unsuitable and potatoes will not stand water-logging. The crop is one of the few which will tolerate the absence of lime.

The potato is a crop of temperate climate with moderate rainfall. The high rainfall of the West Coast and parts of the North Island render the crop very susceptible to Potato Blight, heavy top growth with delayed maturity or difficulty in gathering. A rainfall between 25 inches and 35 inches per annum is most suitable. Where a wet summer is experienced second growth may occur and the quality of the tubers is impaired.

The tops are cut back by frosts of 4 to 5 degrees. A rapid thaw is more injurious than a slow one and for this reason early varieties are usually grown on dry shady faces where there is less risk of frost injury. Planting the main crop is usually delayed until the frost risk has passed.

Place in Rotation

The crop is an expensive one to grow and harvest and in order to reduce costs per ton, growers should take steps to secure the highest yields possible. The best results are usually obtained when potatoes are grown after good pasture and in many cases they are a safer crop to grow than wheat or oats. The decaying turf provides the humus that is so necessary for high yields. On land where previous cropping has depleted humus reserves, potatoes can be grown after red clover or after blue lupins ploughed in as green manure. On very strong land potatoes and wheat may be grown alternatively for several years and in the early growing areas potatoes can be grown each year provided care is taken to keep diseases under control.

Preparation and Planting

The potato is a crop which does not require a firm seed bed. The land should be worked to a deep, loose (but not fine) condition with the plough and the cultivator. After old pasture the land should be skim ploughed in the summer or autumn, and sods being turned flat and rolled to assist with the rotting of the turf. The furrow may later be cut with the discs and further broken down with the harrows. In the winter the land should be deep

ploughed, turning the turf to the bottom of the furrow. The frost breaks down the surface and by suitable work with the cultivator or plough the land can be prepared by mid-October for planting.

After blue lupins ploughed under for green manure in August or early September, surface work with discs and harrows will assist the rotting of the lupins and potatoes can be safely planted in mid-October, with little further work. There are several methods of planting adopted by farmers according to the district, and equipment available.

(1) The potato ridger. The land is first ridged with a double mould-board plough. The "seed" and fertiliser are then placed by hand along the furrows and the ridges then split, covering the seed in the process. The method is slow and requires a lot of labour.

(2) Potato planting machines—single or double row planters—are very satisfactory. With these machines shallow furrows are opened by a double mould-board, the "seed" and fertiliser deposited in the furrow and then a pair of discs covers the "seed" and fertiliser all in the one operation. When large areas of potatoes are grown these planters soon repay their cost in labour saved.

(3) In Canterbury the most common method is to plant with the plough. A 3-furrow plough with furrows set at 9 inches will set the rows at 27 inches apart. The tubers are planted by hand or from a hopper on the plough. Fertiliser is also applied by hand or it may be applied from a hopper attached to the plough.

The size of the "seed," the width of the rows and the distance apart in the rows controls the quantity of "seed" necessary to plant an acre. A common method is to make the rows 27 inches apart and set the seed 16 inches apart in rows. At this spacing when 3 ounce seed is used about 16 to 18 cwt. will be needed to plant an acre. A greater or lesser quantity will be necessary according to the size of the "seed." It is a mistake to plant potatoes deeper than 2 or 3 inches.

Seed Treatment

It is always advisable to sprout and green tubers before planting. The "seed" may be greened by spreading the tubers in a shallow layer under the shelter of trees, after risk of hard frosts has passed. Alternatively the tubers may be bagged in manure bags, placed singly along the sunny side of a fence and turned at intervals.

When potatoes are cheap it is a common practice to plant table size tubers. These are usually cut into two or three parts from the rose to heel end. The cut tubers should be planted immediately before the cut faces dry out, otherwise a high proportion of rotting may occur. Treatment with lime has proved to be of little value. Aucklander Short Top, King Edward VII and Robin Adair do not cut as well as other varieties.

Fertiliser

A good supply of organic matter or humus is essential for high yields. It is usual to obtain this from the decayed turf of the old pasture or from a crop of Blue Lupins or red clover ploughed in as green manure. If a supply of farmyard manure or stack bottom is available, this should be ploughed in about 4 inches deep. In addition to the organic matter artificial fertilisers supplying phosphate and nitrogen give payable increases. In the main potato growing soils of Canterbury, 3 cwt. of superphosphate or its equivalent and 1 cwt. of sulphate of ammonia applied close to the "seed" at planting time is recommended. These can be mixed.

The fertiliser may be applied with the planter or when the plough is used it may be spread by hand in a narrow band along the bottom of the furrow. Broadcasting the fertiliser is less effective. In regions of high rainfall heavy applications of fertiliser are given and in the Auckland district from 8 to 12 cwt. of superphosphate and 4 to 6 cwt. of sulphate of ammonia are used. It is advisable to add 5 cwt. of lime with this heavy dressing of sulphate of ammonia to prevent the soil from becoming too acid. The lime must not be mixed with the sulphate of ammonia.

After Treatment

Probably no crop responds so well to after cultivation as does the potato. When planted by plough on the flat several harrowings should be given to conserve moisture and to destroy weeds during the first 4 to 6 weeks until the plants are up to six inches high. When planted on ridges the rows should be intercultivated at regular intervals to maintain a loose tilth and keep down weeds. When the ridges have been broken down they should be remoulded and left until weed seeds germinate, when the ridges can be harrowed down. In this way weeds are destroyed in the rows as well as between rows and moisture is conserved. After the potatoes are through, inter-row cultivation should be continued and if weeds are bad within the rows, harrowing may be resorted to until the plants are 4 to 6 inches high. Light moulding can

now be introduced with the inter-row cultivation and can be continued until the tops are touching across the rows, when the final moulding up is given. Moulding up must be done thoroughly as a good cover of earth is necessary to protect the tubers from greening, from blight infection and from the potato moth.

Digging

The crop is usually dug in April or May while the ground is still relatively dry. It is wise to wait until the tops have died off as by this time the skins of the tubers are tougher and suffer much less mechanical injury than when lifted earlier. Care is necessary throughout digging operations to avoid excessive injury to the tubers. Cut or bruised tubers will rot when pitted and considerable monetary loss may be incurred by careless work.

The crop is usually dug with a potato digger. Where large areas are handled a sorting table can be attached to the digger and sorters, standing on the machine, sort the seed into bags as the crop is dug. More commonly the digger drops the tubers on to the ground and these are picked up and sorted by gangs of pickers.

Pitting

Potatoes which are not sold off the paddock are usually stored on the farm in pits. The objects of pitting are to protect the crop from frost and rain and at the same time to allow a certain amount of ventilation. The pits are usually constructed on a dry sheltered site where the work of sorting can be carried out during winter with some protection against cold or wet weather. On a well drained site the pit can be sunk a foot or so in the ground. It should be from 6 to 9 feet wide, and the potatoes tipped loose or stacked in bags to a height of 3 to 4 feet. They must be thoroughly covered to protect them from frosts. It is advisable to cover the potatoes with sacks and then with a good thick layer of straw (3 feet), both on the top and sides of the pit. Finally the whole should be covered with bag sheeting. Sheds are sometimes used for storage.

Sorting and Grading Potatoes

During storage an inevitable loss occurs as a result of respiration and disease. Before the crop is delivered it will be necessary to sort out the diseased and damaged tubers from the healthy ones and to grade the potatoes into table, seed and pig size, if this has not already been done. Hand sorting from the pit is slow and the mechanical grader was introduced to speed up this work. The diseased and mis-shapen tubers are sorted out by hand and the remainder are graded into table, seed and pig size by wire riddles of various sizes. A certain amount of bruising is caused during grading and this may lead to subsequent rotting of the bruised tubers. To avoid this loss the sorting table has been developed. A bag of potatoes is elevated onto the table by a hoist and the tubers are tipped out. In travelling down the table any soil and small tubers fall through while the larger tubers are graded by hand.

Grading for Seed

To be readily saleable a line of "seed" should be free from diseased and damaged tubers, free from "rogues" and of a uniform size. The size will vary from small to large but any line of "seed" should be evenly graded. The method of recording the graded size of a line of seed is to sample the line by taking 25 tubers from 1 sack in every 6 sacks. These tubers are then set out in groups of 100 tubers. From each group of 100 tubers the 16 largest tubers and the 16 smallest tubers are sorted out and weighed separately. The average weight of the 16 largest and the 16 smallest are recorded as e.g. 5/3. These figures mean that the 16 largest tubers average 5 ounces and the 16 smallest average 3 ounces. The average weight will be 4 ounces. The uniformity of the grading is represented by the difference between the two figures given. In the case of certified seed certain standards of grading have been decided upon, e.g. the smallest seed must have a grade in which the 16 smallest tubers weigh not less than 2 ounces, and the 16 largest must weigh not more than 4.3 ounces. Thus a grade 2/2.5 (average 2¼ ounces) would be considered a very evenly graded line while 2/4.3 (average 3.1 ounces) would be more uneven but is within the limits set. If the grade were 2/4.5 (average 3¼ ounces) the difference is greater than is permitted and the line would have to be regraded before it could be certified. In the case of large "seed" which may be purchased with the object of cutting there is no limit other than the difference between two weights which is limited to 3.6 ounces. Thus a line with a grade 8.4/12 (average 10.2 ounces) would be certified but one with a grade of 8/12 (average 10 ounces) would have to be regraded before it could be certified.

Certification

Seed potato certification was introduced by the Department of Agriculture in 1927. The scheme has as its objective varietal purity, freedom from seed born diseases and

associated high cropping power.

The essential features of the scheme include:—

(1) The growing in a central trial a sample of the tubers which the farmer is actually planting and the detailed inspection of these from time to time.

(2) The inspection of the farmer's crop when it is flowering.

(3) The inspection of the graded produce of the crop, before leaving the farm to ensure uniformity of grading and reasonable freedom from tuber diseases and blemishes.

(4) The issue of certification tags which are attached to the sacks of tubers passing the requisite standards.

A grower who wishes to produce certified potatoes must forward in early September his application to the local officers of the Department of Agriculture who will instruct him as to his course of action.

There are two grades of certified seed into which a crop may be classed according to its cropping power, freedom from disease and purity. The highest grade is "Mother" seed and should be used for planting when the objective is to produce "seed" which is eligible for entry into certification.

The second grade is certified "commercial" seed and this grade should be planted for ordinary commercial purposes. The seed from this commercial crop is not eligible for entry into certification.

A list of growers of certified potatoes is published by the Department of Agriculture in May of each year and a copy of the list can be obtained from the local office of the Department. The growers of "Mother" seed and "Commercial" seed are listed separately and particulars are given as to cropping power of each line certified to enable a prospective purchaser to choose his seed.

Maintenance of Pure and Healthy Stock

Potatoes are susceptible to certain diseases which though they do not cause rots are responsible for low yields. It was formerly believed that potatoes underwent natural degeneration but it is now known that most deterioration is brought about by virus diseases which are spread by certain insects particularly the greenfly. In warm dry districts it is almost impossible to keep these diseases in check, but in cooler districts the insects are not so prevalent and it is possible to maintain healthy stocks by rogueing out degenerate plants. It is not possible to detect the disease in the tubers and a grower may purchase a heavily infected line which would produce a diseased crop. However, the diseases do produce characteristic symptoms in the stems and leaves and these make it possible for the farmer to rogue the diseased plants from his crop and so produce a healthy crop. It was in this way that certain growers had built up healthy stocks which formed the basis of certified seed when the Certification Scheme was inaugurated. As a result of this scheme a high standard of freedom from virus diseases in certified lines has been reached but constant rogueing is necessary to maintain this standard. The cooler districts of Otago and Southland and the upper regions of the Canterbury Plains produce more healthy "seed" than the warm dry plains and this is due to the small number of virus-spreading insects in these cooler areas. It is in these localities that the best class of seed can be produced by rogueing but on the warm dry areas of the plains it is almost impossible to secure a sufficiently high standard to produce "Mother Seed" even by the most careful rogueing.

When setting out to produce high grade "Mother" seed the best quality seed should be planted. It is waste of effort to try to improve a badly diseased line. During the growing season the crop should be inspected several times and on each occasion all slow-growing and unhealthy plants should be dug out and removed from the field. Probably the most reliable method is to maintain a "selection" block which can be more thoroughly handled. It should be not more than an acre in size. During the growing season it is carefully rogued at frequent intervals. The block is dug by hand and any plant which produces a low yield or badly shaped tubers must be discarded. Tubers from the high-yielding plants are retained to plant the next season's selection block, while the remainder of the tubers from the selection block are used to plant the main crop for the production of certified "Mother" seed.

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CANTERBURY CHAMBER OF COMMERCE

AGRICULTURAL BULLETIN

Organic Matter and Nitrogen in the Soil

Prepared by the Canterbury Agricultural College, Lincoln.

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The mineral basis of a soil may be regarded as a mass of rock fragments, sand and silt, partly held together by a gelatinous coating of clay. This mass of mineral material is gradually transformed into a soil by the addition to it of organic matter from plant and animal residues. This organic matter is generally in an active state of decay through the work of millions of organisms which live in the soil. Some of the softer materials are readily broken down, while other woody fractions are rather resistant and remain in the soil as the stabilising reserve substance—humus. It is this partially decomposed and resistant material which has such a marked effect on the physical properties of the soil, while the readily decomposable part provides the plant foods.

The value of organic matter and humus in the soil is well known to farmers and gardeners. Active organic matter is the balancing and stabilising material of the soil. Its effects are equally desirable on both heavy land and light land. It binds a sandy soil and lightens a heavy soil, so that all soils, irrespective of texture, tend to develop a desirable granular tilth when provided with adequate humus. Soils rich in humus are usually dark in colour, and since dark colours absorb heat such soils are usually warmer and, in general, are more productive than light coloured soils. Organic matter absorbs and holds water freely so that the addition of organic material improves the water retaining capacity of the soil. Humus promotes the building up of the soil particles into small aggregates or granules and thereby eases the handling of the soil, improves aeration, water absorption and drainage.

Soil organisms (the invisible plant and animal life in the soil) use the organic matter to provide energy for their growth and reproduction, and in so doing they change the nitrogen, phosphate and other plant foods bound up in the organic materials into simpler forms that plants can use in their growth. In addition to these more common nutrients, organic matter and humus contain many of the lesser known but equally important growth promoting substances known as hormones. Some of the outstanding results which attend the application of green manures, compost and animal excreta may be due to these hormones. Moreover, many of the products of decay are soluble and increase the power of the soil solution to dissolve plant foods from the mineral part of the soil.

Organic Matter and Nitrogen

Soil fertility is largely dependent upon the transient plant food—nitrogen. Constant replenishment of the soil reserve of nitrogen is essential for the maintenance of high fertility, and the chief sources of nitrogen are based on the additions of organic matter and the use of legumes which carry nitrogen fixing organisms in nodules on their roots. Soil organic matter contains both nitrogen and carbon in varying proportions depending upon its source and the state of decay. Farm manure and legumes contain about one pound of nitrogen to 25 pounds of carbon. Non-leguminous green material (such as cereals and lawn clippings) contains about 1 pound of nitrogen to 40 of carbon, and dry matter (such as straw) contains about 1 pound to 90 pounds. The decay organisms in their bodies carry about 1 pound of nitrogen to from 6 to 10 of carbon, and humus has a ratio of about 1 of nitrogen to 12 of carbon. These figures show that carbon is liberated in considerable amounts during the decay of the organic matter. Even so, there is always a shortage of nitrogen during the early stages of decay, and the decay organisms themselves

compete with any plants for the available sources, thereby producing a temporary nitrogen starvation. It is mainly for this reason that the turning under of heavy additions of organic matter must be followed by an interval of some weeks before a further crop is sown. Garden refuse is preferably composted rather than buried for the same reason. The soil supply of nitrogen is also helped along by light additions in rain equal to 30 to 30 pounds of sulphate of ammonia per acre per year and through the activities of special nitrogen fixing bacteria in addition to those associated with the legume nodules.

Losses of Organic Matter.

The soil reserve of organic matter is depleted by fires, surface washing from rolling lands and by cultivation in arable areas.

Fire usually destroys all of the dry organic matter lying or standing on the soil, together with part of that which is incorporated with the surface soil. Fires have been important foctors in depleting some of the natural tussock grassland and may even be used to excess after headers on harvested crops of the plains, though here the difficulty of handling the straw and the necessity for controlling weeds and insect pests tend to make burning customary. Burning, by reducing the thickness of the plant cover, also paves the way for the washing off of the surface soil, a process which accelerates continuously unless retarded and checked by the restoration of the organic matter.

In order that the crops may obtain nitrogen from the organic matter this must decay, and during the active growth of the crop the soil must be kept in such a condition that the successive stages in the breakdown of the complex nitrogen compounds to simple forms useable by the crop is fairly rapid. The decay organisms are most active during warm moist soil conditions and they are comparatively inactive in cold soils. The close connexion between the crop and the decay organisms is often shown by autumn sown cereals during early spring. Crops on such soils often turn yellowish and growth remains stationary in spring until the decay organisms start their cycle of growth and replace the plant food nitrogen washed out by the winter rains.

Cultivation tends to stimulate the organisms and hasten the decay of the organic matter. This simplification of plant foods and the building up of a reserve of available plant nutrients is one of the main results of summer fallowing. Cultivation processes, and fallowing, help to mobilise the reserves of nutrients locked up in the organic matter but they do not increase the reserves. The production of frequent cultivated crops is possible only when equally intensive methods are used to, restore the organic matter supply.

Maintenance of Organic Matter

There are many methods of adding organic to the soil and the farmer or gardener must make full use of the methods which are most suited to his farming programme.

On Farming Land.

The methods which are applicable on farms depend largely upon the type of farming carried out and, for purposes of discussion, the following divisions may be made: unploughable pastoral country, ploughable pastoral country and arable country.

On the unploughable pastoral areas there are no suitable methods of making large additions of organic matter and the maintenance of an adequate supply is assured only when the additions from the natural plant cover and grazing animals are sufficient to compensate for the losses through decay, soil washing and, where it is practised, burning. At present, on much of this class of country, losses more than counterbalance additions and this is shown by steady deterioration of the plant cover. This trend may be reversed, in some areas at least, by reduction in stock numbers, the carrying of a larger proportion of grown dry stock, and by periodic spelling of blocks from grazing.

On the ploughable pastoral country the problems of making frequent additions of organic matter are much more easily handled. Here full use may be made of improved pastures and forage crops. This class of country tends to improve steadily because much of the organic matter, especially that in the dung and urine of the grazing animals, is added in a very active state. The improvement in organic matter reserve tends to be cumulative. A very high maximum level of production is approached as liming and topdressing are developed, pastures improved and grazing is intensified.

On the arable country the trend

upwards or downwards in organic matter content and nitrogen reserves is determined by the balance maintained between depletive crops and restorative crops. The maintenance of organic matter under arable farming is covered in bulletins 107 and 155 where attention is drawn to the part played by liming and manuring, leguminous crops, rotation of crops, forage crops, green manure crops and pastures.

In Gardens.

In order to maintain the soil in good tilth and to compensate for the intensive annual production of a garden, frequent additions of organic matter must be made. This may be applied as the fresh unfermented material or in a partially decomposed state.

The sources of organic matter which are available to the home gardener are garden and kitchen refuse, special green manure crops, stack bottom, animal manures, sawdust, commercial organic manures and garden compost.

The burying of soft, readily decomposable garden refuse and kitchen waste such as vegetable and fruit trimmings, is valuable and provides a considerable bulk of material over a year. Moreover the continued burying of such material gradually increases the depth of topsoil.

Gardeners rarely have their land vacant long enough to grow a catch crop, though when an early crop has been removed and the ground is not required for a succession crop it is beneficial to sow blue lupins, cape barley or mustard to be dug in later. These green manure crops are best dug under in autumn when the soil is warm and decay takes place rapidly but, if the bulk of growth is not sufficient, the digging in may be delayed until early winter or even early spring. In such cases the next crop must not be sown until the green material has decayed.

Well rotted stackbottom is one of the best sources of organic matter and full use should be made of it on paddocks being prepared for roots and forage crops and on gardens.

Farmyard manure, if available, is an excellent source of organic matter for garden soils. There is a great variation in the composition of manure from different animals. This is due mainly to the difference in moisture content. Horse, sheep and poultry manures are low in water and are known as hot manures in that they decompose readily and during the process liberate much heat. Pig and cow manures, on the other hand, carry more water and are cold manures. Both hot and cold manure may be used fresh or rotted. Rotted manure is preferable if it has been well stored. If good covered storage is not available the manures should be spread on the soil surface when fresh at 5 to 10 pounds to the square yard and immediately dug in. Poultry manure should not be used at more than 2 or 3 pounds per square yard. The best results are obtained when these manures are applied and dug under in autumn so that they may weather down during the winter. These farm manures are all rich in nitrogen and potash but are low in phosphate, and an application of manure should be followed by a dressing of 3 to 5 cwts. to the acre of superphosphate applied at the time of, or just prior to, planting.

The use of sawdust is gradually being extended but owing to its woody nature and slow decay its use should be confined to soils of very heavy texture. It acts as a very effective mulch for many shrubs such as rhododendrons.

The organic manures such as blood and bone, tankage, and bone dust are excellent sources of nitrogen and phosphate and they are widely used on vegetable and flower gardens. They do not add much to the organic matter content but they do stimulate decay.

Most of the disadvantages of turning under undecomposed materials and fresh farm manure are overcome if these materials are composted. In this they are subjected to decay under conditions controlled to favour rapid breakdown with maximum retention of plant nutrients. Even as the farm manures vary in quality according to origin and storage so composts vary according to the nature of the composted materials and the efficiency with which the operation is carried out. There are many variations in the procedure but the following principles always apply.

The best material is soft, green and readily decomposable though semi-mature and mature garden waste may be effectively used; the heap must be built in alternate layers of organic material and good moist soil; it must be kept moist and yet be aerated and well drained. Fertiliser salts and lime may or

may not be added to hasten rotting and to enrich the product.

With the exceptions noted below, nearly all other kinds of waste material such as lawn cuttings, kitchen waste, immature weeds, leaves, wood ashes and farmyard manures should be pitted in bins or built into a heap in a sheltered part of the garden. Coarse woody materials like cabbage stalks, maise and hedge trimmings, should be chopped with a spade or bruised with a roller before use.

Never use diseased plants or soil carrying very serious weeds such as white cress, twitch or convolvulus or weeds carrying ripe seeds.

The thickness of the layers of refuse and of soil depends upon the type of material used; sappy green material should be added in layers which, when compacted, are about 6 inches deep, while dry, rather hard materials may be made up in layers of 12 inches. The soil layers are 3 to 4 inches. Each layer of material may be sprinkled with ½ oz. to each sq. yard of sulphate of ammonia (or 1 oz. of blood and bone) to supply nitrogen and hasten decay, and ½ oz. of superphosphate, or with 2 ozs. of ground limestone. The layers are repeated until a heap 5 or 6 feet high is built up. The top should be covered with a layer of soil and after settling should be slightly hollow to facilitate watering at a frequency sufficient to keep the heap moist but not saturated. The mass soon begins to decay and heat, a process which is accelerated if some semi-decomposed compost from an older heap is incorporated during building. After 3 or 4 months it requires turning, restacking and trampling. This is repeated until the mass is uniform and well decayed. Compost should be ready for use in 6 to 9 months.

The process may be hastened to produce compost in 3 months if good soft material is used and the whole heap is watered with Condy's Crystals applied at the rate (per cubic yard) of 6 ozs. dissolved in 3 gallons of water. This heap must be turned after one month and again watered at the rate (per cubic yard) of 3 gallons of solution made up with 1 oz. of crystals to each gallon of water.

The mature compost may be used for building up the humus content of the garden, for enriching seed rows, top dressing lawns or, if of special quality, it may be diluted with sand for the raising of seedlings and for potting plants.

Summary

Organic matter and the rather stable complex end product of its decay—humus—is present in all fertile soils. Though present in small amount in most mineral soils it markedly affects the soil tilth and exerts considerable influence on the water holding and fertiliser retaining capacity.

It furnishes the raw material for the microflora of the soil and they, by the decay processes which they carry on, obtain the energy necessary for their growth and reproduction and ultimately leave as by-products available to the growing crops most of the nitrogen, phosphate, potash and other plant foods contained in the added organic matter.

To remain living, active and productive, soils require frequent additions of organic matter. On pastoral farms the organic matter is added in a very active form in animal excreta and by pasture grasses and clovers. On arable farms, animal excreta, pastures, leguminous crops, forage crops and green manure crops are used. Home gardens, for which many of the farm methods are not suitable, should be maintained by digging under kitchen and garden waste, green manure crops, stackbottom, animal manures, sawdust, and commercial organic manures. The value of these organic materials is improved if they are rotted down in a well prepared compost heap.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.

ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE

AGRICULTURAL BULLETIN

Bloat or Hoven in Cattle and Sheep

Prepared by the Canterbury Agricultural College, Lincoln.

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True bloat or hoven is a disease of the ruminant, to which class only sheep and cattle, of our farm animals, belong. These animals have a digestive system that is peculiar in structure and function and it is by virtue of this possession that they alone can become truly blown. Other farm animals than cattle and sheep, although they may occasionally suffer from an allied condition, cannot develop bloat because they do not possess the wherewithal to do so. Why then is the development of this condition the prerogative of ruminants?

In nature ruminant animals had to rely on natural cover and a certain fleetness of foot for their protection from beasts of prey. At certain times of the day they would move out to their grazing grounds, eat their full hurriedly and without much chewing and then repair to some secluded spot where they could lie down and proceed leisurely and with relative safety to rechew the store of food they had gathered. As a consequence, by a process of natural selection, they developed a complex stomach with four compartments and great capacity, from which they could return the food to the mouth for rechewing by a process known as rumination.

Further than this, the ruminant is typically an herbivorous animal, it derives its nourishment from plant materials after they have been digested. Of the plant materials, the starch, protein and fat are broken down and rendered available to the animal by special enzymes or ferments produced by glands in the stomach and intestines. Cellulose, however, which is one of the chief constituents of plant material, particularly of hard, dry, woody hays and straws, is not broken down by any of these enzymes, nor does the digestive system produce any other enzyme to render this material available. It is, nevertheless, made available to the animal by a process of fermentation brought about by the activity of ferments in the plant material itself, and by the numerous bacteria and other micro-organisms in the stomach. This process of fermentation, which takes place chiefly in the first compartment, or paunch, of the stomach, is invariably associated with the production of a certain amount of gas. The gas is normally eliminated by belching or eructation, a procedure which is characteristic of ruminants, and dependent upon the normal churning movements of the paunch wall.

If for any reason, the gas cannot escape or the rate of elimination does not keep pace with the rate of production, it must accumulate in the paunch and the animal "blows up" producing the condition known as bloat or hoven. It will thus be appreciated that the special features of ruminants making them, and them alone, susceptible to bloat are — the structure of the stomach, the rapidity of food consumption and the natural process of fermentation which is necessarily associated with the production of gas. A knowledge of these features is essential to a logical study of the causes, symptoms, treatment and prevention of this condition.

Causes

Briefly the causes may be classified under three headings:

1. Those relating to the food.
   (a) The nature of the food. Excessively fermentable foods such as lucerne, clovers and other succulent leguminous plants, particularly if they are wet, are probably the commonest cause of bloat. If the food is of this nature and is also cold, it is doubly dangerous, e.g., frost covered

lush clover pastures.

(b) The quantity eaten and the rate of ingestion. The greater the quantity and the quicker it is eaten, usually the more serious and rapid the "blowing."

2. Those relating to the normal functioning of the stomach.

Partial or complete paralysis of the stomach wall may be caused by many factors.

(a) The chilling effect of cold or frozen food; obviously made worse if the food is easily fermentable or if the animal is weak or sick.
(b) Long draughts of cold water.
(c) Digestive disturbances. All such conditions lead to loss of tone of the stomach wall and predispose to bloat.
(d) Poisonous plants of many kinds.
(e) General debility or sickness.
(f) Distension of the stomach with gas. This obviously has a cumulative effect.
(g) Large quantities of food to which the animal is unaccustomed.

3. Those relating to obstruction of the gullet and therefore preventing or reducing the normal escape of gas.

Pieces of turnip, mangel or potato stuck in the throat bring about immediate "blowing" and are the commonest cause under this heading. Occasionally, also, enlarged lymph glands between the lungs press on the gullet and render the animal more susceptible.

From the point of view of the distribution of gas in the stomach, there are two classes of bloat.

(a) Cases in which the gas lies in bulk on top of the food in the stomach.
(b) Cases in which the gas is distributed in small bubbles throughout the food, producing a frothy, effervescent mass.

Although there is no distinct demarcation of these two classes, in a general way, those of the first class are more often due to causes related more specifically to the animal—cases caused by obstruction of the gullet belong entirely to this class—while those of the second class are more often due to causes related to the nature of the food. Appreciation of these facts is helpful in deciding on methods of treatment. It is obvious, for example, that cases of the first kind can be relieved immediately by probing, whereas this method is practically useless if the gas is distributed throughout the food mass.

Treatment

Objects of Treatment:

1. The immediate removal of gas.
2. The prevention of further excessive fermentation by medicines which reduce fermentation.
3. The removal from the stomach of the offending material by the use of purgative medicines.
4. The prevention of recurrences by the use of tonic medicines, particularly in cases where the cause is related to the function of the stomach.

Methods of Treatment:

1. Procedures which assist the escape of gas by belching. These are of use in all but the severest cases.

(a) Forced exercise, make the animal run round the paddock.
(b) Tie a rope round the abdomen and draw it tight. This increases the pressure and obviously must be used with caution.
(c) Place a bag over the head. Belching is facilitated by the animal throwing its head in the air.
(d) Stand the animal with its fore-quarters higher than its hindquarters, either by standing the animal on a ramp, or with its hind legs in a ditch, or by driving it up-hill.
(e) Place a stick or rope in the mouth and fasten it over the poll. Smearing either with tar or molasses is helpful.

2. Procedures which release the gas directly. Except the first, these must be used in all advanced cases where it is evident that death will take place unless the pressure is relieved immediately.

(a) The Probang. This is a long leather or rubber tube which is introduced through the mouth into the stomach. As a substitute a suitable length of garden hose may be used. As a rule its use is not attended with good results, because the gullet enters the stomach below the level of

the food and the tube tends to become blocked with food. Its passage, however, sometimes stimulates eructation, and it may be used to convey medicines into the stomach.

(b) The Trocar and Cannula. This is a sharp pointed, solid metal rod (trocar) about six inches long, enclosed in a closely fitting metal sheath (cannula). It is thrust through the body wall and stomach wall in a downward, inward and forward direction at a point equi-distant from the last rib, the hip bone and the transverse processes of the loin vertebrae on the left side — where the swelling is greatest. The trocar is withdrawn and the gas allowed to escape slowly through the cannula. The trocar should be replaced and then both are withdrawn. Antiseptics such as formalin, dettol and lysol in water may be poured directly into the stomach through the cannula.

When such an instrument is not available, a long, sharp-pointed knife will usually serve the purpose. After thrusting it in, it should be turned to allow the gas to escape.

If time and materials are available, the trocar and cannula, or knife should be sterilised by boiling, the site of operation rubbed vigorously with methylated spirits or iodine and the wound treated with stockholm tar.

(c) Rumenotomy or incision of the abdominal and stomach wall. This is the last resort and is used only when all other methods have failed. As already mentioned, in a number of cases, the gas is not free, but intimately mixed with the food, producing a frothy, effervescent mass. Medicines may have all failed, and the only material escaping after probing with the trocar and cannula or knife is a small amount of frothy green fluid. In such cases, if the animal is still in dire distress and it is estimated that it will die in a short time unless the pressure is relieved, rumenotomy must be performed. The operation may be performed in various ways and with varying degrees of crudeness or delicacy. For the average farmer the procedure is as follows: Take a long sharp knife, introduce it as for probing and then draw it downward, making an incision about six inches long through the abdominal and stomach walls. Draw the cut edges of the stomach wall as far out as possible and hold them tightly against the abdominal wall so that no food material escapes between the two, and then allow the frothy fermenting food to escape. If necessary rake it out with the hand. Then with a curved bag needle and seaming twine, and as much asepsis as possible, sew the four walls together with one row of deep stitches and cover with stockholm tar. If possible call in veterinary assistance to repair the injury.

3. Medicines which stimulate eructation or bring about condensation of the gas. The following are some of the more common remedies used in the treatment of bloat.

(a) 2-3 fluid ozs. (4-6 tablespoonfuls) of turpentine in $\frac{3}{4}$-1 pint of raw linseed oil. In order to prevent the irritant effect of the drug on the mouth and stomach, turpentine should be well shaken up with oil, milk, or mucilage. This is probably the best all round remedy.

(b) 2-3 ozs. of sodium bicarbonate (baking soda) in a pint of water, to which is sometimes added 2 ozs. of ginger.

(c) 2 ozs. of sodium hyposulphite in a pint of water.

(d) 2 drachms (2 teaspoonfuls) of formalin in 2 pints of water.

The last three mixtures are more useful as medicines to prevent further fermentation after the gas has been released. They may also be used two or three times a day in cattle which suffer from chronic blowing.

The second object in treatment is to reduce the excessive rate of fermentation. Since this is due chiefly to the activity of various micro-organisms in the stomach, it can be controlled by any suitable antiseptic substance. The material may be administered as a drench or passed directly into the stomach through the probang or the inserted cannula.

In addition to those mentioned above, the following may be used. Dettol, carbolic acid, Lysol, Kerol or Jeyes' Fluid mixed with water to give a weak antiseptic fluid.

The third object in treatment is to remove the offending mass of food from the stomach. This is best done by the administration of a saline purgative such as the following.

Epsom or Glaubers Salts	½lb.
Common Salt	½lb.
Ginger	1oz.
Treacle or Molasses	1lb.

Dissolve in 2 pints of warm water and give as a drench.

After severe attacks it is advisable to restore the tone of the digestive system and bring it back to a normal working condition. The animal should be put on nutritious soft feed and kept under careful observation for a few days. A course of tonic powders such as the following is often helpful,

Common Salt	6ozs.
Powdered Nux Vomica	1oz.
Powdered Gentian	6ozs.
Powdered Ginger	6ozs.

Divide this mixture into 6 doses and give one in a pint of water twice daily. This is a useful stimulant mixture for cattle that do not recover quickly after a serious attack.

Prevention

Since most farmers are familiar with the kinds of food and the circumstances that predispose to blowing in cattle, it is unnecessary to discuss this subject in detail. Obviously care must be taken to avoid, as far as possible, all those circumstances described under causes above, which may bring on an attack. Special care must be taken when feeding off luscious clover pastures. Animals should not be allowed on to such pastures when they are hungry, they must not be left on long, and they should be carefully watched and moved about the paddock during grazing.

Summary for reference in cases of emergency:

1. Drench with 2-3 ozs. of turpentine (4-6 tablespoonfuls) shaken up in 1 pint of raw linseed oil or milk.

2. Where the animal is down and unable to rise probe with a trocar, or cannula, or a knife where the swelling is greatest at a point equi-distant from the last rib, the hip bone, and the transverse processes of the loin vertebrae. If this does not bring about relief, enlarge the size of the hole.

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ELLESMERE GUARDIAN

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AGRICULTURAL BULLETIN

Future Aims In Animal Breeding

Prepared by the Canterbury Agricultural College, Lincoln.

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The animal breeding methods of the past have been responsible for the evolution and consolidation of the breeds of farm live stock and they gave us the great herds and flocks we have today. During the past twenty years, however, accumulating evidence shows that these methods have taken us nearly as far as they can and that by continuing along them we can hope for little more than the maintenance of our present position. Rapid advance must be preceded by the acceptance of a new set of aims and standards and it is the purpose of this bulletin to place these before breeders. Subsequent bulletins in this series will deal with the application of these principles.

Usefulness The Aim

The main justification for farm live stock is their "usefulness" as efficient producers of milk, wool, meat or eggs. In addition, it may be developed into an object of beauty, provided this does not interfere with the attainment of maximum usefulness.

The Difficulty of Selection

It is important to have a clear cut aim in the breeding of any kind of animal. Unless we know what we want in definite terms we cannot hope to produce a true breeding group of stock in which every animal is valuable. A noted American animal geneticist states the main object very well when he says, "The aim in animal breeding should not be to produce better animals than we have today but to be able to produce the most useful that we have got, uniformly, and at will." To the major aim of "usefulness" we must add therefore, "uniformity" meaning by this stock that will breed true for the useful characters required. Gambling on the off chance of occasionally breeding an outstanding individual will never secure a uniform true breeding line of animals. Such a gamble is characteristic of our present day aims and methods and involves continuous "outcrossing" or the mating of "extremes" within family groups in such a way as to increase the mixed nature of the inheritance of such stock. Rather must we set out to obtain animals which consistently reproduce their kind; with variation reduced to a minimum, fluctuating only with differences in environmental conditions and with a uniformly high standard of "usefulness" as the end in view.

It is equally important that animals should be bred to suit the environment in which they are placed. If they are not adapted to the environment then failure results or increased costs must be incurred to adjust the environment to suit the animal. Appreciation of this fact by breeders of the past has led to the development of breeds and types specially fitted to suit almost every sort of environmental conditions, but present day breeding methods far too often ignore this principle completely.

Our aim of usefulness must be now extended to include adaptability or suitability to environment and we can summarise our "aims" in stock-breeding in the terms "usefulness," "uniformity" and "suitability to environment."

Progeny Testing the Method

To improve the present level of performance of our stock it is essential that serious consideration be given to breeding methods which have their ability to bring about improvement. Methods based on straight selection always result in a new generation differing but little from their parents in productive efficiency. Selection based on a "progeny test" is the only method by which the aims mentioned above can be obtained and further progress assured. In this connexion, Hagedoorn states, "It is really very curious to see how slowly the importance of progeny testing is recognised. It seems obvious that as the only real object of a bull is to produce daughters, the only really important question to ask when buying a bull is whether he is likely to produce good daughters. The only safe way to answer this question is to see how he has actually bred."

Observation of the methods of breeders shows that there are many to be converted to the principle of selecting sires according to how they breed rather than how they look or perform. The method is not new and it was extensively used by the breed founders but in recent years it has been allowed to fall into disuse.

The modern breeder claims, with some justification, that there are difficulties which place the method beyond the means of the average breeder. These difficulties include:—

(1) The number of females which must be used for testing purposes;
(2) The time required to test a male, which makes it necessary to keep on hand many males under test or run the risk of losing valuable sires by death or sale;
(3) The cost of keeping a lot of sires, many of which eventually prove to be inferior breeders.

These are real difficulties where flocks or herds are small and to them must be added the technical difficulties of carrying out a progeny test in any flock or herd so that the results obtained are reliable.

However, these objections are no longer valid in respect to dairy cattle breeding, as the dairy industry has organised for itself a "Sire Survey," by which an increasing number of "Proven bulls" — bulls that have demonstrated their ability to leave daughters of particular production standards — are becoming available to the industry. There is now no reason for the breeder of stud dairy cattle to continue using untried dairy sires, yet the number of pedigree dairy herds using "Sire Surveyed" bulls is very small.

Similarly in pig breeding the above objections cannot be sustained. The prolificacy of sows enables boars to be tested in a short time and the industry has an organisation which could permit the development of a national progeny testing scheme involving accurate measurement of productive qualities from birth to bacon. Yet little, if anything, is being done along these lines. Boars are still selected on appearance backed by show ring records and pedigrees and stud breeders are merely the propagators of existing types, the standard of which remains almost stationary.

The sheepman has a more legitimate grievance in that he has not been provided with any clear cut method of progeny testing, although work along these lines has been in progress at Agricultural Colleges and Research centres for some years. Even so he has not yet demanded a scheme, as has the dairy farmer.

Most sheepmen have large flocks and most of our important studs are sufficiently large so that the scope for progeny testing by the individual breeder is greater than in the case of the dairyman or the pigman who have to work with smaller numbers of animals, and in the case of the dairyman, a much slower developing animal.

Rams, mated as lambs to about twenty ewes, can be tested and their breeding capabilities known by the time they would be normally used as two-tooths. Simplified methods of evaluation designed to

suit the breed and the breeder but with usefulness as their aim, are easily designed. Such a method would add little to the task of looking after the stud flock but would remove the great gamble of attending the ram fair and purchasing a ram that "looks right," is "bred right," and costs three figures, in the hope that he will "breed right."

It is important to stress here that any method of progeny testing must keep in mind the three aims of usefulness, uniformity and adaptability. The measure of excellence of a bull, boar or ram must be its ability to leave efficient producing stock—not merely good looking stock. If they are good looking, so much the better, but the real test must be their ability to produce at a high level for a long productive lifetime.

The second —uniformity— means that we must aim at a sire which leaves uniformly "high quality" average progeny rather than one which sires a few good ones, a few very bad ones, and a majority of mediocre ones. The "average get" must be the criterion of the worth of the sire.

The third — adaptability — means that the progeny test selection must be carried out in the environment in which the animals are going to be used. By this is meant that dairy cattle in New Zealand should be bred, progeny tested and selected under grassland dairying conditions and not under conditions which involve housing and the feeding of concentrates; that sheep to be used in light rainfall inferior grassland areas should be bred, progeny tested, and selected in these areas and not in heavy rainfall rich grassland areas where nutrition alone may be so different that similar performance could not be expected; that pigs intended for use on the average dairy farm where they are expected to perform efficiently on a diet consisting chiefly of skim milk and under rigorous management conditions, should be bred, progeny tested and selected under these conditions.

Most stud flocks and herds are situated on the very best farm lands and consequently most stud animals are reared under the very best environmental conditions. Such conditions permit a full expression of inherited tendencies and provided they remain the best conditions economically possible of attainment in the environment where the stock are to be used they are of real assistance in the selection of superior animals. It is only when conditions quite artificial to the best commercial farms are employed that there is a likelihood of animals unsuited to commercial conditions being evolved.

If we are to accept "progeny testing" based on the measurement of "usefulness" as the foundation for further improvement in our live stock, we must be prepared to review critically the factors which dominate our present methods of selection.

Selection on Type

"Type" has long been the foundation stone of selection. Where it provides some index of "usefulness" it can be a valuable basis. This is the case where animals are bred for their carcase and where "hoof" judgment is likely to have some agreement with "on the hooks" judgment. Thus, selecting Southdown sheep at an early age for shortness and thickness of bone is sound, as it has been shown that these characters are good indications of shortness of bone throughout the carcase, blockiness of form, amount of muscle and rate of maturity.

"Type," however, can be a real bar to progress when it places stress on characters of no "useful" import or when type characters that have some association with productive qualities replace more reliable methods of evaluation. The former is well illustrated by the importance attached to the face and leg colour in Southdown sheep although no one has shown any relationship between these characters and carcase quality. The latter is seen in dairy cattle breeding where the aim is milk and butterfat production but where less than twenty per cent of the commercial dairy cows (and an even smaller proportion of pedigree cows) are under test, breeders preferring to guess at

productive capacity on "type" rather than submit the animals to the test of accurate measurement. In this connexion it has been suggested that if there is an association between type and production then selection for production will automatically result in stock of the right type. This statement is well worth serious consideration.

The Influence of the Show Ring

The show ring has played a helpful and important part in bringing our livestock to its present day standard. It has allowed comparisons which have given a standardisation of ideals; has stimulated interest in the breeding of good stock; and it has been valuable educationally in demonstrating the qualities—at least in appearance—of the different breeds and types of farm animals. The main disadvantage of the present-day system of showing is the rigid adherence to judgment on "type" and in particular, of the stress placed on type "beauty points" rather than on "usefulness." That this weakness is already recognised in some quarters is shown by the provision of "Type and Production" classes. The wider use of such classes together with progeny classes for males would serve to make the show ring a potent force in future stock improvement, although in some cases it would change the venue of judging from the ring to the bucket, the scales and the hooks.

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ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

INCREASING FARM PRODUCTION

Prepared by the Canterbury Agricultural College, Lincoln.

Bulletin CHRISTCHURCH, JANUARY, 1944. No. 174.

Introduction

The following declaration was made by the representatives of the forty-four United Nations assembled in conference at Hot Springs, Virginia, from the 18th May to 3rd June, 1943.

"This conference meeting in the midst of the greatest war ever waged, and in full confidence of victory, has considered the world problems of food and agriculture and declares its belief that the goal of freedom from want of food suitable and adequate for the health and strength of all peoples, can be achieved.

1. The first task is to complete the winning of the war and to deliver millions of people from tyranny and from hunger. During the period of critical shortage in the aftermath of war, freedom from hunger can be achieved only by urgent and concerted efforts to economise consumption, to increase supplies, and distribute them to the best advantage. . . ."

See New Zealand Hot Springs Conference Report, Government Printer. Cost 9d.

The urgency of the need to increase food production is generally recognised. The means by which this can be done is equally well known. The practical application, promptly and effectively, of already existing knowledge is what is required.

In England production and economies in consumption have increased to such an extent that whereas formerly she supplied approximately 30 per cent of her requirements she now supplies approximately 70 per cent. In other words, output in relation to consumption as reported above has more than doubled.

In New Zealand farm production during the present season shows alarming evidence not of an increase but of a decline. For example pig production has decreased to approximately one-half of its former figure and dairy production for the first two months of this season has been estimated to be 28 per cent lower than for the corresponding period of last season.

The problem is how to convert this decrease in some lines, and possible trend towards a decrease in other lines through sale of capital stock, into a large increase of farm output. It is certain as shown by England's example and some individual farmers' increased production in N.Z. that, provided labour, materials and prices are favourable, a very great increase of farm output is possible.

Methods of Increasing Production

In England the handling of the problem of increased output was narrowed down by placing responsibility on small local committees whose job it was to give helpful advice as to methods of achieving the increased output required. Encouragement was given by raising the prices of farm products, subsidising ploughing up programmes, advancing working capital and providing and maintaining on the farm some skilled male labour and a large increase of female labour.

Somewhat similar steps might be advisable in New Zealand if we intend to carry out our obligations and increase our farm production. The problem can be narrowed down by considering production by counties and appointing advisory committees headed by men appointed by the farmers in each county or riding or sub-county area who have proved their ability to increase farm production. Certain little used roads and areas within boroughs at pres-

ent vacant should be utilised. Areas concerned with city milk supply, market gardening, poultry, honey, and pig production would also require to be included in the programme for increased production.

An example will serve to demonstrate the type of problem to be dealt with and the method by which an actual increase in farm production might be achieved. A particular farmer who formerly ran six cows now runs only three and the cows have not been replaced by increased production of other lines. His production has declined as the result of pasture deterioration and culling of the cows. Production could easily be brought back to 6 or 7 cows by rearing three extra calves, by regrassing, and, to a still greater extent, by provision of a small area of lucerne for hay and winter feed. The most productive method of establishing the necessary pasture and lucerne would be first to take a crop of potatoes out of the ground as a clearing crop, then resow in good grass and lucerne; lime and top-dress.

Advice from the representatives of the local production committee combined with suitable prices and financial assistance as indicated above could effect the necessary changes.

In general the methods of increasing farm production are well known. They involve farming more intensively, i.e., raising land from a lower to a higher plane of use, farming the more marginal areas, overcoming the factors limiting production in each particular case, getting the land in good heart and making the plant, stock, crops and pastures suitable for increased production. For example, on most of the medium to good land merely placing one paddock of lucerne on the farm together with necessary harvesting facilities through increased provision of supplementary feed, contribute to an increased stock production.

Food Production per Acre

The following may serve as a guide in selecting the methods of farming that should be adopted in any particular case.

The greatest food production is obtained by the market garden system of farming where the fertility is maintained by green manuring, application of farmyard manure and other fertilisers. Therefore as large an area as possible of suitable land on which marketable products can be grown, should be put into market garden crops. Concentration on main crop products and storage of these will permit a much greater total production from a given area than will be obtained by the production of special extra early or extra late crops. Similar principles apply to out-of-season stock production.

Next to market gardening in food output per acre comes the rotational cropping system whereby such crops as potatoes, wheat, peas, etc. are grown. Direct consumption of crops from the land will sustain approximately eight times as many persons as when the stock eat the grass and crops and the resultant meat or milk is then consumed by the people. Nevertheless not all land is immediately suitable for direct crop production.

Next in food productivity comes grassland farming. The most productive method of grassland farming occurs where the grass is treated as a crop and periodically resown. Italian ryegrass and red clover, underseeded on a cash crop where the land is in good heart and free from weeds, alternating every two years cash crops, probably secures the highest possible stock and crop production per acre. Old and run-out permanent grassland provides much less food per acre.

Assistance Required

(a) Finance.

In order to secure the necessary improvements, finance, labour, plant, materials and stock are required. Additional finance could be obtained, provided, under war conditions, a sufficient price to induce the increased production aimed at is offered. Sustained and increased production is the immediate and urgent need to replace the present declining trend. Therefore as in England the financing of efforts to increase production where necessary should be introduced.

Where high income taxation is a deterrent—higher net incomes after taxation being obtainable by extensive rather than intensive methods of farming—this deterrent might be overcome by establishment of maintenance reserve funds to be available for use after the war or if not so used, to be finally taxed away. This fund could be set against working account losses in later years when used for post war working and rehabilitation expendi-

ture but if not so used could be finally taxed away. A procedure somewhat similar to this applies in England.

(b) Labour.

In New Zealand farm labour is strictly limited. According to the results published in a recent book by Colin Clark, the net productivity per head of New Zealand farm workers is amazing. It is the highest in the world, being almost four times that of U.S.A.; over five times that of Great Britain and twenty times that of Japan. Colin Clark's figures are: New Zealand, 2,444; Australia, 1,524; Argentine, 1,233; U.S.A., 661; Great Britain, 475; Japan, 120 units. These figures mean that farm production in New Zealand is maintained to date by the work of the farmer, his wife, and those of his family still on the farm, together with a relatively few employees. For example, in dairying where the milking machines do both the milking and the stripping, output per unit of labour employed has greatly increased. The labour on many small farms could in many cases be more productively used on larger farms. But in the present emergency period this trend must be reversed and more intensive, rather than as at present, more extensive, methods of farming adopted. The training of new labour takes time and the farmer's wife is in many cases already fully occupied in attending to her present work. The diversion of experienced farm labour from other occupations, labour which would need to provide its own household facilities, would provide the best immediate source of additional labour. To induce transference of this labour to farming, with its relative long hours instead of forty hours and overtime, and seven days instead of five days a week, would almost certainly require a complete reversal of present labour rewards for the emergency period.

At present, minimum award rates for adult married or single farm workers are £2/17/6 per week and keep or £3/17/6 per week without keep. All other minimum wage rates on a comparable basis average 33 1-3 per cent higher. To reverse this trend would require either a relative halving of all other wage rates or a doubling of farm wage rates. By this reversal farm wage rates would average 33 1-3 per cent higher than other wage rates. Even then rates per hour might be lower on the farm. Nevertheless such a reversal of weekly wage rates would provide at least in part some of the stimulus required for a return to the farm for such jobs as team work, dairying, shepherding and sidelines. A transference of labour from unnecessary or less urgent work to farm work would almost certainly very greatly increase New Zealand's real income, provided the effect of the reversed farm labour trend was accompanied by a farm produce price trend that had the result of securing a large increased output.

(c) Plant and Materials.

Much of the plant and materials required to be imported can be obtained under lease lend finance and by special shipping allocations. For example increased supplies would be required of animal feedstuffs and/or fertilisers as well as such items as grass mowers, haysweeps, etc. At the same time increased local production of such commodities as fertiliser, lime, drain tiles and farm accommodation would be required and could be effected by working in shifts with the increased labour devoted to these lines.

(d) Stock.

The increased stock can only be obtained through the breeding, feeding and rearing of the animals required, combined with a curtailment of the selling of good young female stock for meat. Much of the present breeding stock are first bred on the hill country and mountain areas and it is on these more marginal areas that a reversal of the present financial labour and relative price declining trends requires to be immediately induced. The surplus stock from this hill country provides the breeding and fattening stock for the lower areas and enables production to be thus multiplied up.

(e) Land Improvement.

The return from the crops and pasture can be assisted by such methods as draining, clearing, irrigating, crop and stock improvement, provision of fertiliser and supplementary feed, growing of leguminous, inter-row cultivated and preparatory crops, regrassing, liming, topdressing, subdivisional fencing and more intensive methods generally. As indicated above the methods

of securing an increased output, the overcoming of the factors limiting production in each particular case, are well known. What is required first of all is that the fullest possible use is made of machinery and labour diverted from less essential to these more essential uses. For example, public works drag-line excavators can be used where local production committees consider improved drainage is the factor limiting production. Caterpillar tractor rolling and ploughing down of weed infested areas provide in some cases the best method of clearing the land preparatory to supplementary forage cropping and regrassing.

As indicated above, provision of increased winter and supplementary feed and increased skilled labour on a relatively profitable basis are urgently required especially on the poorer hill, mountain grazing and marginal plains areas generally.

The prior provision of contract labour and contract machinery, as a reserve for assisting farm production wherever it is most urgently required at the immediate time that changing seasonal conditions warrant it, would also assist production and enable the hay crops grown to be stored for future use.

The making available from the machinery firms of multi-row potato planters and cultivators for the increased potato acreage requested, mowers, sweeps and grab stackers, etc. for the improved stock feeding indicated above, would also enable the farmer to increase production along the more intensive lines now required with his present labour supply.

The requirements of large areas of New Zealand land for lime is well known or can be immediately determined.

By application of contract methods, cartage by rail and lorries, and increased use of lime crushers, a very great increase of liming might be effected.

Conclusion

The urgency of the need to maintain and increase farm production is universally agreed upon; the means by which this can be done are well known; what is required is the diversion of labour, materials and capital from present less urgent uses to the more urgent objects of maintaining and increasing farm production. The raising of the relative price of farm products and of farm labour rewards above those of other activities would probably be necessary. Action along these lines which in fact would increase farm output would also increase New Zealand's real income and at the same time, assist in winning not only the war but also the post-war peace.

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ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

FARM MANAGEMENT FOR CANTERBURY AREAS LIABLE TO GRASS GRUB

Prepared by the Canterbury Agricultural College, Lincoln.

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One of the most destructive insect pests in New Zealand is the grass-grub or brown beetle (Odontria zealandica). This insect, together with the caterpillar of the Porina moth, has been responsible for the destruction of thousands of acres of pasture and large areas of other crops.

The Odontria lays its eggs mainly in November, while Porina is about one month earlier. The actions of the grub of the Odontria and the caterpillar of the Porina become obvious when they have attained one-half to three-quarters their size. This is from April onwards. The actual destruction proceeds throughout the autumn, winter, and early spring, when greatest injury to pastures and other crops is caused. At these times pastures are least able to withstand attack, owing to the dry conditions that often prevail in the autumn and to the lack of growth in winter and early spring.

Over the three seasons, 1937-39 inclusive, the attack was particularly severe. Partial or total destruction of pastures occurred on many thousands of acres of farming land in Canterbury and North Otago. These grubs have not been content with the destruction of established pastures, but significant damage has occurred in newly-sown first-year pastures only one or two months old, and new lucerne areas a few months old have been severely attacked. Autumn-sown oats, both for green feed and crop, Italian rye, and wheat have been seriously eaten out. The greatest damage has occurred on the medium and lighter soils; friable soils in the heavier-land areas have also been subject to severe attack. Grass-grub beetle (Odontria) may also cause severe damage to newly-sown rape and turnip crops. In some seasons large areas of these crops have to be resown.

Effect on Management

The average plains farmer follows more or less an established steady cropping and stocking policy. There is a certain area of wheat, oats, green feed, rape, turnips, and new grass sown each year and a certain number of ewes carried mainly for fat-lamb production. Winter feed requirements are gauged in advance and always include some grazing from both young and old permanent pastures. The effect of a severe grass-grub attack begins to be felt in April, when it is noticed that a number of the pastures are completely eaten out, while others are partially destroyed. From April onwards the pasture feed is reduced but the stock numbers are kept the same, with the result that winter feeding has to be commenced earlier.

In the absence of the normal winter feed from pasture the farmer finds that, although the available supplementary feed (turnips, swedes, chaff, hay etc.) is carefully rationed, it has to be fed in somewhat greater quantity. In mid-winter it is fully realised that the sheep must go short and be allowed to lose condition, or that either extra feed must be bought or some sheep sold so that the remainder may be reasonably fed. When others are trying to buy feed and/or sell sheep, the price of the feed is high and that of the surplus sheep low. Whatever is done can result only in reduced net income.

It is at lambing-time that the effect of grass-grub ravages is most severely felt. Ewes are low in condition and have missed the "green bite" from the pastures so essential to their lambing-time health. The

normal green-feed area, sown before grass-grub ravages were evident, is inadequate. The result is a high mortality in young lambs, an increased susceptibility of the ewe to "dopiness," and a reduced rate of growth of the lambs owing to lowered milk-production from the ewes. It is true that many less severely attacked pastures recover, but it is October before there is adequate grazing. In the winter and spring of 1938 there was severe grass-grub attack in Canterbury. It caused considerable ewe and lamb mortality because it was only the well-established farmer who could buy adequate feed or have the courage to reduce stock numbers at a financial sacrifice. The majority of farmers endeavoured to struggle through. A lambing survival of three hundred and fifty lambs from four hundred and fifty ewes put to the ram was not uncommon on farms where 100 per cent was normally obtained.

The experience of the first sudden grub attack (1937-38) was sufficient to cause a considerable reduction in sheep numbers in the succeeding winter, with additional attention to the provision of adequate green feed both green-feed oats and Italian ryegrass. At the end of the first winter, with a high death-rate in both ewes and lambs, farmers were suddenly faced with raising from some source the income necessary to enable them to meet commitments. In the late autumn, winter and early spring, extra areas were rapidly turned over with the minimum of cultivation—cultivation was partially done by the "grub"—and put into crop for both cash and supplementary feed. A sudden upheaval of a set cropping programme occurred. The effect of this extra cropping in many instances, together with the inadequate pasture area, resulted in the ewes and their lambs being inadequately fed. This was accentuated by the low condition of ewes at lambing-time. After the spring flush of feed on medium-light land pastures there is nearly always a "pinch" period before rape and other fattening feed is ready. Where grass grub had cut down pasture-production and extra cropping had reduced the grass area, this "pinch" period was aggravated to such an extent that malnutrition predisposed many lambs to heavy worm infestation. Even when properly treated from weaning onwards, these lambs, now checked in growth needed a much greater quantity of rape and supplementary feed and a long "fattening" period to raise them to the "prime" state.

All this could have been avoided if reduction in sheep numbers had been made in accordance with the reduced pasture feed supply. However, it is not possible to judge in advance the effect on feed supply of an attack by grass grub.

The farm-management aspect of grass-grub attack may be discussed also from the effect on crop rotations, life of pastures, yield of crops (both cash and supplementary), and the winter feed position generally. A farmer normally establishes a certain cropping and pasture-renewal policy co-ordinated with a given stock-carrying capacity. The required supplementary fattening and winter feed production is fitted in with the pasture renewal and the general farming policy. This policy usually involves following certain cropping rotations. Grass-grub attack upsets this and requires the sowing of more new grass, more supplementary feeds, and more cash cropping. The life of the pastures may normally be five to seven years. A given area is sown in order that, as pastures run out, they may be ploughed for supplementary crops and later sown to new pasture. The area of new grass sown annually may be one-sixth of the pasture area, but with severe grass-grub infestation a farmer may suddenly find that practically all his pastures are eaten out and that there are grub-eaten patches in his one-year pasture. He has at once to resort to the sowing of large areas of green-feed oats, oats and grass, and Italian rye and oats. Many of these hurriedly-sown pastures are of the temporary type. Frequently the grub eats out large areas of these new pastures, and so the expenditure at these times on high quality seeds seems scarcely warranted, thus the saving of this temporary-type pasture for seed is often an economic necessity. It is not until a year or two after severe infestation that more permanent and expensive seeds are sown to any extent. The area awaiting such pastures is large and it is not until five to six years after the severe attack that the pasture position is retrieved, and throughout this period extra areas of permanent pastures have to be sown each year in land temporarily occupied by green-feed oats, Italian rye and extra cash

crops. In bad grass-grub years the life of pastures may be reduced from five or seven to one or two years.

Because of the grub attack over greater or lesser areas, yields of rye-grass seed and wheat are lowered. With a reduced yield and a greater quantity of rye-grass seed required on the farm, together with the fact that most farmers are too heavily stocked to be able to save seed at all, a position of rye-grass-seed shortage is created and is accompanied by higher prices. In order to balance the budget, extra cash crops, usually wheat, are grown. It is not uncommon to find farmers on medium land who normally grow 30 to 50 acres of wheat growing 150 acres. Such large areas are partially, if not wholly sown late, with consequent substantially reduced yields. If, on the other hand, the area was sown early in land ploughed out of grass-grub infested and ruined pastures, the wheat may be affected seriously by the grub.

With large numbers of beetles on the wing in November and early December, rape, turnip, and swede crops are often severely damaged and have to be resown. Resowing often means reduced yields and always increases farming costs. If rape is expected for early or mid-January and is not ready until early February, the lambs may get a severe check and consequently fatten slowly, using more feed to attain a given weight.

As well as being responsible for lighter lamb weights and lower lambing percentages, the effect of grass grub on the total feed supply to a flock of ewes not adequately reduced in numbers results also in wool-clips being lowered, in some instances by as much as 1½lb. to 2lb. per sheep.

Because of grass grub the farm has to be managed so as to reduce the effect of its ravages to a minimum. This results in the practical management details being altered from time to time in matters of crops and their areas, types of pastures sown, and number of sheep carried; stability is difficult of attainment. Instead of the management centring around fat-lamb production, good pastures, and top-dressing, with lesser attention to supplementary crops and winter feed, it has often to centre about producing cash crops and supplementary feeds, with lesser attention to fat-lamb production. The economic significance is often substantial.

Conclusion

One of the most serious farm-management problems confronting the medium-light farmer is grass-grub. The annual loss of net income to the farmer of Canterbury alone is estimated at over £500,000. Further, the disorganisation of farming policy causes decreased production and increased farm expenditure.

The possibility of economic control on a farm scale appears remote, and recommendations meanwhile must be made along the lines of how to alter the farm-management policy so as to result in the smallest financial loss.

Recommendations

(1) Extend the area in lucerne beyond that required for hay purposes so that discriminate grazing of lucerne can be resorted to during pasture shortages due to droughts and/or grass grub. Cocksfoot is a grub resister, and if sown with lucerne provides an excellent mixture for periodic grazing. One hay cut a year will appreciably lengthen the life of a periodically-grazed lucerne stand. Although lucerne may be taken by grub in the first year of the life of the stand, established stands are seldom affected. An area might well be sown in Phalaris tuberosa which is also deep-rooted and resistant to grub attack.

(2) Build up and carry a greater reserve of dry feed, hay, oat sheaves and especially lucerne hay, so that when stock numbers must be reduced, such "surplus" stock are disposed of as "fats" and not as stores. In addition, permanent stock are maintained in good condition.

(3) Fallow well and sow at least one paddock each year in Italian rye-grass and red clover or Italian ryegrass and green-feed oats so that a supply of green feed is always available for winter and spring along with adequate dry feed. After a lengthy fallow, at the worst only patches of this new pasture or green feed will be grub eaten. Under most medium and

light-land conditions it is advisable to sow an area of green-feed oats and lupins each year. In seasons when grass-grub attack is not severe it is advisable to give a paddock a good fallow and sow down to permanent pasture. Such new pasture sown on fallowed land provides a big bulk of green feed and might well replace Italian rye-grass in some seasons.

(4) Always save grass and clover seeds. An area of rye-grass (Italian, perennial, or both) should be shut for seed, and red and white clover seed may be harvested in favourable seasons. Hold at least two years' supply of such "home grown" seeds because, when grass-grub attack is severe, seeds are always dear.

(5) When forced to increase the area in cash crops, avoid early sowing of wheat or oats on land known to be severely infested with grub. If late winter or spring sowing is not wise on the particular class of soil or in the district, then sow wheat in paddocks not severely attacked and make spring sowings of peas, barley, rape, linen flax, and turnips on badly-affected areas.

(6) Unless the whole paddock is ruined, do not be in too great a hurry to plough the affected area. Plough only for a specific and definite purpose. When patches of paddocks are eaten out, often these will recover by feeding hay on them and then spelling, and by light surface working and the sowing of seed.

(7) Avoid loss of rape and turnip crops at the seedling stage, by sowing early or late, i.e., before the Odontria is on the wing and/or after it has laid its eggs.

(8) As a general policy on mixed farms and in grass-grub infested areas, be slightly understocked rather than a little overstocked.

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ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

GROWING TREES FOR TIMBER ON FARMS

Prepared by the Canterbury Agricultural College, Lincoln.

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With the destruction of native forests in many areas in New Zealand, local timber is likely to be available in smaller quantity. The State Forest Service has recognised the position and has established extensive plantations in both Islands. By "land grants" for each acre of trees planted early Governments encouraged tree planting. In recent years farmers have also been assisted in tree planting through the publication of numerous bulletins on tree culture and by allowances made in taxation. For example, in determining the unimproved values, land in native bush or plantations is assessed for land tax purposes on its value, without the trees; but for the assessment of death duties the value of the trees is included in the valuation. Local body rates where levied on the Government unimproved or capital value are based on the value of the land exclusive of the tree values. Income tax must be paid on income received when the timber or the trees are sold but any expenditure on establishment and maintenance are deductible items.

Yields from timber vary according to the "site quality," to the age of the stand and to the management it receives. Some stands of Pinus radiata (Insignis Pine) may be marketable in from 25 to 40 years and will produce from 50,000 superficial feet on light, dry land, up to 150,000 super feet or more per acre under better soil and climatic conditions. The value of timber also varies according to quality and accessibility. At the present time the royalty paid for standing timber — Pinus radiata — is about 6/- per 100 super feet, but it was as low as 1/6 to 2/- per 100 super feet in 1932. Other kinds of trees may not reach marketable condition for from 50 to 100 years. These figures indicate that timber has at times offered an excellent form of investment and may be worth consideration as an additional source of income.

Probably of greater importance on many farms is the value of timbered areas in the control of noxious weeds, checking of erosion and in the utilisation of waste areas. In bulletin No. 118 of this series planting for farm shelter was discussed and reference to that bulletin is recommended. In the present bulletin the growing of trees for timber is considered.

Control of Noxious Weeds

Noxious weeds such as gorse, broom, blackberry, Nassella tussock, sweet briar, etc., are a cause for concern on many farms, particularly on hill country where cultivation is impracticable. It may be possible to control them by poisoning, fire or grazing management but in many places it would be better to plant the area in trees. Various problems arise according to the particular set of conditions. It may be advisable to burn the area to clear it sufficiently for planting. This is an advantage to the trees because competition is reduced and the young trees receive the benefit of the fertilising effect of the ashes. Where the growth is not too dense it may be practicable to cut tracks for planting or even to plant without tracking. Where gorse and broom are tall and opening out it is possible in areas of high rainfall to plant under the shelter of the gorse. The soil under gorse is usually satisfactory for the establishment of young trees. Areas infested with blackberry are more difficult to plant unless a clean burn is secured. Manuka country is probably not quite so good for tree establishment as gorse country but by preparing

the site beforehand, good stands can be secured. In most instances the trees will usually over-top the weed growth in from three to five years and once this has taken place, the growth is rapid and in time the trees will suppress the weeds.

Erosion Control

Soil erosion is a national as well as individual problem. The protection of the main watersheds from soil erosion by afforestation is the responsibility of the State Departments concerned, on many other areas it is the responsibility of the individual. By means of an established rooting system a block of trees is a powerful agent in preventing certain types of soil erosion on farm lands. Where gullying occurs, trees planted at the top of the gully will delay, if not completely stop its extension. Soil on steep slopes can be prevented from slipping by planting trees and much valuable land which might otherwise be destroyed can be saved.

Extensive planting of hill country is strongly recommended as a major method of erosion control. Owners of such country should seek advice from the Forestry Service on planting schemes which should involve a yearly planting, attacking the most dangerous portions first. In this way the expense and labour involved are spread and the work is more likely to be accomplished. A big development of farm planting is likely to eventuate after the war but plans for the future should be made at once so that the work can be proceeded with when material and labour are available.

Two other types of soil erosion can be effectively controlled by tree planting:

(1) Where rivers or creeks encroach on good land by scouring out the banks, the scouring can be controlled by planting trees along the threatened banks. Indiscriminate planting of willows and lack of attention to established stands must not be allowed to result in blockage of streams with consequent risk of flood damage. Judicious planting of willows to control streams is however advisable.

(2) Where wind erosion occurs, with resultant risk of destruction of good land, it is important to recognise the problem in the early stage and take immediate steps to stop the spread. One of the most practical methods is to plant trees across the direction of the prevailing wind. In the early stages a single belt of trees may be adequate but at a later stage, if the eroded area is extensive, successive belts may be required.

The control of many sand dunes is an allied problem and planting trees on sand dunes has become an established practice. When the movement of sand is rapid successful tree establishment is difficult and it may be necessary to stop the supply of sand to the area before the trees are planted. This can be effected by building a manuka scrub fence on the windward side. In time this will be covered by sand and another scrub fence must be built on top. The process must be continued until an artificial dune is formed high enough to stop any more sand blowing over the area. Trees can then be planted without fear of their destruction by a sand covering.

Trees to Plant

Many kinds of trees have been experimented with over the whole of New Zealand and the State Forestry Service is in possession of information concerning the best trees for different districts and situations. A farmer who intends to plant for timber is strongly advised to enquire from the Department regarding the kinds of trees he should plant. A list from which he may select will include:—

The Insignis pine (P. radiata).—The fastest growing tree and most suitable for exposed positions and rough country and for smothering gorse and other weeds. It is also the best tree for light, dry areas.

The Douglas fir or Oregan pine.—Suitable for high rainfall areas, but does not succeed in hot and dry conditions.

Macrocarpa.—Grows well on good land but is not suited to poor or dry areas.

Californian Redwood.—Makes rapid growth under high rainfall conditions.

Maritime Pine (P. Pinaster).—Widely used for dune planting and likely to provide revenue from the sale of resin and turpentine as well as from timber.

Corsican Pine (P. laricio).—A useful timber tree for high altitudes, but is slow growing.

Western Yellow Pine (P. ponderosa).—In some localities a slow maturing tree but produces good strong hard timber in areas of moderate rainfall.

Various species of Eucalyptus are useful timber trees and selection can be made from:—

E. pilularis (Blackbutt).— Warm districts only.

E. eugenioides (White stringy bark).—Warm districts only.

E. obligua (Stringy bark).—Warm districts only.

E. Gunnii (Cider gum).

E. Regnans.

E. macarthurii (woolly butt).

E. gigantia (Red Mountain Ash).

E. viminalis (Mann gum).

The ordinary blue gum eucalyptus globulus is not recommended.

Poplars.—These are fast growing trees and some species can supply useful timber where durability is not required. P. alba, the silver poplar, is ideal for planting in wet situations and a stand will provide a large quantity of timber suitable for butter and other boxes. It suckers freely but this is not likely to cause trouble outside the stand where the suckers can be prevented from spreading by stock grazing. The black poplar (P. Nigra) is another useful fast growing timber tree. The wood is tough and is used for dray and truck bottoms.

Other trees.— There is a wide choice of useful hardwood timber trees such as oaks, ash, walnut, alder, Spanish chestnut, cork oak, which thrive under good soil conditions, supply profitable timber at maturity, help with erosion control, and add beauty to the countryside.

Methods of Planting for Timber

In most schemes for farm timber planting it should be practicable to prepare the land some months beforehand and it is unquestionable that trees planted in cultivated land grow much faster than those planted in uncultivated soil. In the first few years it is possible to grow potatoes or other root crops between the rows of trees. If, in addition, the ground is cultivated round the trees they will grow at an amazing rate. On unploughable land the holes for the trees should be prepared during the summer or autumn so that the soil is weathered and in a good tilth for planting in winter. It is well to pare off the grass round the hole and then dig and loosen up the soil to a depth of from six to nine inches. On rough stony country it may be more feasible to prepare the holes with a grubber.

Trees for timber should be planted at intervals of from six to eight feet (though quick growing kinds can be planted at 9 feet) requiring twelve hundred trees at six feet intervals to six hundred and eighty at 8 feet intervals. The rows can be lined out with plough or with sighting-poles and the required distances kept by means of a measuring-stick. Planting can commence as soon as the danger from dry weather has passed, i.e., April-May and can be continued into August or September. It may be advisable to postpone planting in July in the colder districts except for the hardier kinds. Care must be taken to see that the roots are prevented from drying out before planting. Provided the roots are well spread in the planting hole it is an advantage to dip them in a creamy mixture of clay and cowdung. It is essential to see that the soil is tramped firmly round the roots and the trees are planted to the same depth as in the nursery bed. Young trees (yearlings) are usually the most suitable for planting.

Trees may be established by direct seeding, using a drill in cultivated ground and employing coulters at six to eight feet apart. The seed must be drilled shallow on a firm, clean seed bed in the spring, summer or early autumn. Broadcasting the seed is not a very successful method of establishing timber stands though it may be adopted when other methods are not practicable.

Trees for planting can be obtained from reliable nurseries or can be raised from seed. This is a simple and economical method varying little from that used to raise cabbage or lettuce plants in the garden. A seed bed is prepared and the seed sown shallow in spring, summer, or autumn. The seedlings should be shaded. When from two to three inches high they can be lined out at from three to six inch intervals in rows in the garden and kept weeded and, if necessary, watered throughout the dry period. Pines and gums will grow rapidly and when sown in October should be a foot or more high in April. Then they should be wrenched as soon as the dry weather is past. Wrenching consists of cutting the tap root at a depth of about six inches below the surface with a sharp spade, slightly lifting the plant in the process. This encourages the production of fibrous roots and renders transplanting, which can be done six weeks later, more certain. The young trees can be wrenched more than once if growth is too rapid.

Management

When trees are planted at from six to eight feet intervals, it is necessary to thin out alternate trees when they begin to get crowded. The number of mature trees finally grown will vary between 300 and 400 per acre. The trees are removed in the sapling stage and the thinnings used for rails, stakes, temporary fences and also for rustic work and firewood. This system of management encourages rapid growth in height and a small development of lower branches. In order to produce good clean timber the lower branches should be trimmed close to the trunk when the latter is from four to five inches in diameter. Subsequent increase in diameter will then produce clean timber free from knots. The first trimming with P. radiata should be carried out at from seven to ten years and from ten to fifteen years for other kinds. At this time it is necessary to clean only the lower four to six feet and later trimmings can be carried out to a height of twenty feet or more.

Protection from Fire

Fire is the chief enemy of timber stands and precautions should be taken to lessen the fire risk. The most efficient protection is a ploughed fire break surrounding the block or across the direction from which danger is likely to come. This break must be thoroughly cultivated and this involves ploughing in the early summer before the grass dries out. A lucerne stand is an effective protection. Where large plantations are established it is a wise precaution, when possible, to have the area declared as a fire district with powers to enforce restriction as regards fire lighting, smoking, etc. A supplementary means of reducing fire risk is to plant two or three rows of silver birch or English beech trees around the block of timber trees.

Fencing

It is essential to protect young plantations from hares, rabbits and farm animals and this necessitates fencing, often of the rabbit proof type. This is a costly item in the establishment of plantations but the expenditure must be faced if the plantation is to be protected from these destructive agencies during the critical stages.

Beautifying the Landscape

Besides providing shelter and a means of revenue, trees increase the beauty of the landscape. This aspect of tree planting should receive due attention when new planting schemes are under consideration. While plantings of one class of tree are usually recommended in any one block, other blocks can be planted in different trees and the outside rows of each block may also be planted with other varieties to add to the aesthetic value of the whole. When one sees the beautiful plantations that have been created in this way by a few of the earlier farmers it will be realised that much remains to be done by the present generation.

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ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

UTILISATION OF NEW ZEALAND WOOLS

Prepared by the Canterbury Agricultural College, Lincoln.

Bulletin CHRISTCHURCH, APRIL, 1944. No. 177.

Very little information is available to wool producers about the use normally made of their clips. What fabrics are woven from the £16,000,000 worth of wool produced in this country each year? In actual fact, it is not easy to answer this question precisely because many lines of wool are suitable for several alternative uses. It is not possible to follow special lots of wool through sorting, blending with wool from different sources, and through many different factories or processes to the finished fabric. The exact destination of any particular clip, or part of a clip, depends upon market conditions, supplies of labour and machinery, and the abnormal demands or lack of demands for certain types of cloth brought about by wars, booms and depressions. Wool consumption, however, tends to fall into certain broad trends of uses; short fibres can never be used in place of very long fibres; coarse fabrics are fundamentally different from fine wool fabrics, while wools with serious defect can seldom be substituted for high grade raw material. The purpose of this bulletin is to indicate the general direction of these trends and their bearing on farming practice.

Many changes must be wrought upon the fleece to convert it from a loose collection of fibres standing side by side, to an end to end arrangement in strong threads suitable for weaving or knitting. As pointed out in Agricultural Bulletin No. 167—"Wool, Its Use in Manufacture"—two different methods of effecting this conversion are available to the wool manufacturer. These produce yarns, and hence fabrics, of fundamentally different structure. In the first system—the woollen system—long fibres form the centre or core of the yarn, and the shorter fibres point in all directions. This gives a soft, fuzzy thread without great strength, suitable for blankets, rugs, tweeds and flannels. In the second system—the worsted system—short fibres are first removed and the longer fibres are laid parallel and twisted. This gives a firm, smooth yarn of great strength suitable for hard wearing serges, and fine fabrics for suits and costumes. Speaking very broadly, the woollen system of yarn production is designed to make best use of cheap, short fibred wools, while the worsted system uses the longer and more valuable, raw material.

Although fibre length plays an important part in deciding the methods employed in wool manufacture, fibre fineness largely determines the softness, or handle and many other valuable properties of the final fabric. So important is the average fibre fineness of a wool sample that the term "quality" is often applied solely to this one feature of the material. Fine wools are said to be of high quality. For many purposes this use of the word is apt to be misleading because garments made from fine wool, while soft and warm, do not withstand hard wear and tend to shrink rapidly on washing, unless the wool has been specially treated.

Merino Wools

Merino sheep, which grow the finest and most valuable of the true wools, produce only approximately two per cent of the Dominion's clip. The best merino wools come from Australia, where, in general, conditions are ideal for growing sound, long stapled, regularly crimped, snow white fleeces, free from serious dust and dirt contamination. Merino wool goes to make the finest and softest of all wearing apparel. When processed on the **worsted system** it gives us luxury

underclothing, fine coatings and the greater part of cloths used for men's suitings, as well as the better quality knitting wools and fine hosiery. **Woollen spun** merino yarns give us cashmeres, delaines, fine flannels, billiard cloths and fine dress and coating materials.

Corriedale and Halfbred Wools

Much more important than Merino wools in New Zealand are those grown on the Corriedale and Halfbred sheep of the South Island. Very often these go into fabrics which set out to imitate, at a cheaper price, cloths made from finer wools. Such fabrics can usually be recognised by their harder handle and more lustrous appearance. Typical Corriedale and Halfbred wool fibres are half as coarse again as those found on the Merino, and this difference is responsible for the harder handle, because the coarse fibres do not bend so easily. In this case soft handle, although a good indication of power to retain warmth, would be a false guide to ability to withstand hard wear.

Romney Wool

In general, coarse fibre wools go to make strong fabrics of great wearing ability, to be used where appearance is a secondary consideration. This applies particularly to the bulk of New Zealand's wool clip, which is derived from sheep of predominantly Romney blood. Romney wools are about twice as coarse as the finer lines of Merino, and nothing can be done to change the characteristic handle of fabrics made from them. Even the best and most beautifully grown wool of this class still possesses a relatively coarse fibre, which sets a limit to the sort of fabric which can be manufactured. There is a saying about a silk purse and a sow's ear which applies very aptly to the utilisation of the stronger grades of wool. At the same time many types of cloth can be made successfully only from strong wools. Such fabrics as saddle tweeds and battledress, though lacking in softness and perhaps in appearance, have great strength and wearing power. In addition, of course, they have the advantages common to all wool goods — of warmth, ability to give out heat when wetted, great capacity to absorb moisture, elasticity, and resistance to burning. Among specific materials made from strong crossbred wools on the **worsted system** might be mentioned uniform cloths of all descriptions, warm working clothes, cheap hard wearing serges for school children's clothing, cheap knitted goods and heavy working socks, and certain types of linings. From the shorter fibred material, manufactured on the **woollen principle,** we get sports tweeds, blankets and rugs as well as cloth for overcoats and army greatcoats.

Strong Wool Breeds

Small, but appreciable quantities of very coarse wools are grown in this country by Lincolns, Leicesters, and strong wool Romneys. Where the fibres are long these wools go into speciality fabrics such as bunting and filter press cloths, as well as into furnishing materials, cheap socks and other working clothing. Short fibred wool of this type goes to make carpets, coarse tweeds and blankets, horse covers, and certain types of felt.

Skin Wools

Freezing works contribute a relatively large quantity of wool to the New Zealand clip. Skin wools, or slipes as they are called usually have less than 12 months' growth and the short staple makes special machinery necessary for processing. Slipe wools often have a proportion of Southdown blood, which makes them of special value to the knitwear trade. One reason for this is that Down-type wools are more springy and give a soft, spongy type of yarn. Another reason is that Down-type wools are considered to be less subject to shrinkage on washing.

Tendency to shrink is another characteristic of wool goods which is related to fineness. Fine fibres stretch and contract with relative ease, especially when wet. When the fibres move, their surface structure comes into play, and they wander, in much the same way as a worm crawls, from one thread of yarn to another. This causes entanglement and results, ultimately, in the felted structure which is characteristic of badly washed wool goods. Blankets made from fine wools are an expensive luxury because they shrink so much when washed. The relatively coarse fibres found in crossbred wools, by contrast, are not so easily deformed when wet. Though lacking in softness, blankets, working socks and heavy duty knitwear

made from stronger wools have a longer useful life. This still applies when the comparison is made with goods containing finer wools subjected to some, at least, of the anti-shrink treatments. Of course, the tickle, which is disliked by people with sensitive skins, is more pronounced when the raw material contains coarse fibres. Even the tickle, however is claimed by some authorities to be advantageous, because it stimulates the skin and promotes circulation.

It is clearly not possible in a bulletin of this length to touch more than the high spots of such a wide subject as the present one. One general principle, however, does emerge. It is that the major portion of our clip is used in fabrics where durability and service are the main requirements. This conclusion must be considered in planning our sheep breeding and farm management programme because it establishes the factors which make for excellence in crossbred wools. It seems obvious that soundness, or freedom from breaks and tenderness, must be given attention before worrying over a little harshness, or a small amount of hairy fibre. A further point is of interest here. All but the very shortest fibred strong crossbreds are still long enough for combing if market conditions demand it. At the same time, wool that is bad for one purpose is first class for another. This combination of facts, coupled with the use of crossbreds in relatively rough cloth, results in only a small premium being paid for quality in the broad sense of the term, i.e., within fineness grades. The sheepman growing strong crossbred wools can safely work on the principle that the most profitable wool for him to grow is the one which gives him the highest weight of clean, scoured wool per sheep, and per acre of country in use. There is, however, a qualification to this. Under harder environmental conditions, which are more suited to the production of finer wools, the principle can only be applied within count or fineness grades. Although at the present time the premium paid for fineness is not great, it is sufficient to compensate for loss of weight in finer fleeces but within any given fineness grade, the advice is particularly sound, because research has shown that the heaviest fleeces tend to be the most desirable from a buyer's point of view. For example 10 pound fleeces of 46s quality are, on the average, worth more **per pound** on a clean basis than 7 pound fleeces of similar count, and the grower gains both ways. Similarly among halfbreds of say 56s count, 8 pound fleeces are more valuable per pound, than 6 pound fleeces.

Artificial Fibres and Future Prospects

The uses of New Zealand wools, too, have an important bearing on the artificial fibre problem. Although in the future there is little doubt that man-made fibres with all the valuable properties of wool will be produced, at the present time most "ersatz" materials are lacking in durability. They cannot, therefore, compete directly with the major portion of our clip. It is possible, also, that the handle and appearance of fabrics made from crossbred wools will be improved by the admixture of a finer staple-fibre. This will increase the range of materials in which our product can find an outlet. It must be remembered, however, that some crossbred wools are used because they are cheaper than Merino wools. If the price of fine wools is kept low by competing materials, the demand for crossbreds must suffer in sympathy. It seems likely, too, that the availability of large quantities of cheap substitutes may reduce the possibilities of wool prices soaring to phenomenal heights, as they did after the last war.

The uses of crossbred wools have a further important bearing on possible future market trends. In wartime, growers of coarse crossbred wools tend to receive a premium above the peace time value of their product, because strong wools are in demand for uniforms, warm, hard wearing underwear, army blankets and great coats and even for certain munitions. Fine wools, on the other hand, tend to suffer because of reduced civilian demand for the less utilitarian fabrics. At the present time (March, 1944) there are indications that war demands are falling back to a maintenance level and it is likely that stocks of coarse wool will commence to accumulate. Under post war conditions such stocks may not be as easy to sell as the stocks of fine wools which have been built up during the war to meet rehabilitation needs. Even in 1942, South American crossbred wools of super style 40/44s quality fleece were selling for as little as

9¼d. on an uncontrolled market. Shipping clearly plays a part here, but the disparity with controlled prices in Empire countries gives cause for serious thought. It seems likely that the world price of strong wools may fall considerably, and breeders might well consider now, the possibility of utilising a finer wool ram on their flocks in the near future.

This advice is given with very considerable reserve, for forecasts of trends in wool prices are notoriously unreliable. The effect which a wool-starved Europe will have on prices is not easily predicted and in the long run there is the probability of increased wool consumption in backward countries to be considered. Just what part economic controls will play has not yet been made known, but it seems certain that both war-ravaged Europe, and the newly developed markets will demand a cheap product. This might absorb a surplus of crossbreds, but it might also be met by increased production of synthetic materials. In either case, the indication is still towards a lower price for the stronger grades of crossbred wool.

Unfortunately, it is impossible to get reliable information about wool stocks, while vague newspaper statements give no indication about the composition of "strategic stockpiles" in terms of different wool types. Decisions about the ultimate post war disposal of such stocks must be taken now if plans are to be laid so that the programme can develop without delay. Adequate publicity for these decisions would enable wool producers, in turn, to plan their breeding and management policies to best advantage and with the minimum disruption of the national economy.

Conclusions

(1) Fine wools are utilised for high priced luxury cloth while strong wools of the sort mainly grown in New Zealand go into fabrics required for durability and hard wear.

(2) Because of the coarseness of the fibres, even the most beautiful strong wools, from a breeder's point of view, cannot in general be used to make high quality cloth.

(3) Fleece features affecting cheapness of production and fibre durability are more important, in most New Zealand wools, than features affecting harshness of handle or finer points of quality in the broad sense of the term. This makes fleece weight of prime importance in breeding.

(4) Research has recently shown that on very much of our sheep farming country, fleece weight must be considered in relation to fineness grade. Even under present market conditions the premium paid for finer wools compensates for appreciably lower fleece weight.

(5) Artificial fibres are not likely to compete directly with New Zealand wools in the near future, but the New Zealand grower will be indirectly affected if a reduced price is paid for finer wools.

(6) Strong crossbred wools may be difficult to sell soon after the end of the war, suggesting that now might be the time to consider using finest wool rams consistent with efficient meat production.

(7) New Zealand wool growers should take steps to discover, as accurately as possible, the amount and composition of existing raw wool stocks, and the extent of control which is planned for the Post-War wool industry, so that management and breeding programmes can be rationally planned.

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ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

WASTING DISEASE AND INFECTIOUS PARALYSIS IN POULTRY

Prepared by the Canterbury Agricultural College, Lincoln.

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Introduction

Many diseases in poultry cause progressive emaciation or wasting. Affected birds are said by the farmer to "go light." Furthermore a symptom common to many of these diseases is a partial or complete paralysis of the legs, usually referred to as "leg weakness." Chronic "wasting" with or without "leg weakness" may be caused by any of the following conditions: tuberculosis, chronic coccidiosis, pullorum disease, heavy infestation with external parasites, or internal parasites such as round worms or tape worms, and faulty feeding methods. In addition to these there are two other conditions which are probably the commonest causes of wasting and leg weakness, **Infectious Leucosis** and **Infectious Paralysis,** which, for the purpose of this bulletin, may be regarded as two rather distinct manifestations of the same disease.

These two conditions are serious diseases of poultry which are becoming increasingly widespread, almost to alarming proportions, a circumstance which is doubtless due to modern intensive methods of poultry production in the use of mammoth incubators, battery brooders and the wide dissemination of day old chicks. The object of this bulletin is to give a brief account of the cause and nature of the disease, to outline the symptoms of its various manifestations so that the farmer may at least become suspicious of its presence, to draw attention to the methods of spread, and to describe the only means as yet available for control and prevention.

The Cause

Leucosis and Fowl Paralysis are infectious conditions caused by a virus. Although some doubt still exists, it may be assumed that they are caused by one and the same virus.

Viruses are minute living organisms somewhat smaller than the smallest bacteria. Their size places them beyond the limit of vision with the highest powered ordinary microscopes. Normally they pass through the pores of unglazed porcelain filters which hold back the smallest bacteria. Many important highly infectious diseases of man and animals are caused by viruses; such, for example, as measles, mumps, infantile paralysis, and small-pox in man; distemper in dogs, swine fever in pigs and foot and mouth disease and cow pox in cattle. Each of these diseases is caused by its own special virus, which on gaining entry to the body, attacks various organs and tissues producing the characteristic effects of each specific disease.

The virus of Leucosis and Fowl Paralysis acts in a rather unique fashion. It attacks the tissues in the body whose special concern it is to manufacture red and white cells for the blood. As a consequence, these tissues run riot and instead of producing ordinary blood cells in normal numbers, they begin to manufacture enormous numbers of primitive kinds of cells which fail to differentiate into useful blood cells. These cells, which refuse to mature and function normally, on escaping into the blood stream, are transported to various parts of the body where they continue to grow and multiply in this out of hand fashion, sometimes forming large tumour-like masses. Ultimately the blood and certain other tissues and organs become flooded with these cells to the extent that they are unable to perform their normal functions and dis-

ease becomes manifest. Such riotous proliferation of primitive cells is like cancer in its various forms and indeed Leucosis and Fowl Paralysis is a kind of cancer caused by a virus. Not all cancers, of course, are caused by viruses; few in fact are.

Depending largely on the kind of abnormal blood cells produced and the organs and tissues affected by their subsequent growth, various manifestations of the disease make their appearance.

Types of Leucosis

1. Erythro-Leucosis—

In this condition normal red blood cells are not produced. There is marked anaemia and the blood, which is thin and watery, contains large numbers of immature red cells, particularly in the tiny vessels of the bone marrow, liver and spleen.

2. Mycloid-Leucosis—

In this type cancer-like growths occur in the white blood cell forming tissue of the bone marrow, and characteristic cells appear in the blood stream in such great numbers that the proportion of white to red cells changes from the normal of about one to a hundred to one to two.

3. Lymphatic-Leucosis—

From the frequency with which the liver is affected this type is sometimes called "Big liver disease." In it, the liver and spleen are often enormously enlarged up to ten times their normal size by the accumulation of lymphocyte like cells—another kind of abnormal white blood cell. Sometimes these cells are grouped together into tumour-like masses. At other times, they are distributed more or less evenly throughout producing swelling of the whole organ. Other organs such as the ovary and kidneys may be affected. Sometimes the internal structures of the eye are involved giving rise to distortion of the pupil and a gradual loss of sight.

Symptoms

Although deaths may occur suddenly without previous illness, it is usual for increasing numbers of fowls to become droopy, dull and unthrifty with a gradual paling of the combs and wattles. Loss of appetite and the development of a bright green diarrhoea are associated with progressive emaciation until affected birds are little more than a mass of feathers. Affection of the eyes causes a gradual loss of sight for which the casual observer can see no explanation.

The occurrence of the disease in a flock is rarely spectacular. As a rule a few birds are lost every week and such deaths are often attributed to the "normal" losses that occur on every poultry farm.

Fowl Paralysis

In this form of the disease the virus attacks the nervous system, causing the aggregation of large numbers of lumphocyte-like cells into masses of tumour tissue, particularly along the large nerve trunks in the body. These accumulations of cells so interfere with the function of the nerve trunks that partial or complete paralysis of the affected parts develops. Thus the nerves to the legs, wings or neck may be involved producing a paralysis of the legs or wings or a wry-neck. Sometimes the nerves supplying the internal organs are affected resulting in marked disturbance of their normal function.

The symptoms displayed thus depend on the parts of the nervous system attacked and the degree of damage done.

At first perhaps only one leg is slightly affected and the foot is raised high and brought down sharply. As the paralysis advances the bird walks on the clenched-up toes. Later, one or both legs give way under the body and progression becomes a series of kangaroo-like hops. Sometimes the neck becomes twisted. Occasionally the breathing is laboured and rattling and the bird emits at intervals a shrill cry rather like a seagull.

In the early stages, except for the paralysis, affected stock appear otherwise normal. Their appetite is maintained and occasionally recovery takes place. Often this is only temporary, to be followed in a short time by a serious relapse.

Fowl paralysis usually develops slowly over a period of many weeks. The duration also is long, as a rule extending over 2-6 months. Death usually occurs sooner or later from gradual advance of the disease. Recovery is rare, and in such cases the majority of birds remain stunt-

ed in development throughout life and not infrequently become virus carriers.

The rate of mortality varies greatly in different outbreaks. In some, as many as fifty per cent of the birds are lost. More commonly the mortality is between five and fifteen per cent.

Method of Spread

The virus escapes from affected birds in the droppings. Consequently contaminated food and water and the litter on the floor of the henhouses become sources of infection. It has also been demonstrated that blood sucking parasites such as mosquitoes and red mite may transmit the disease. In view of this information it is easy to appreciate how infection may be spread rapidly among the flock.

Furthermore, the infection may be transmitted through the egg. Up to 30 per cent of fertile eggs from infected farms may contain the virus. Thus the disease may be introduced to a clean property by the purchase of eggs for incubation, day old chicks or young stock from an infected farm.

There can be little doubt that modern methods of poultry production using such devices as mammoth incubators, battery brooders and the wide distribution of day-old chicks are largely responsible for the dissemination of this serious disease. Once introduced the virus is believed to remain alive and infective for at least 4-6 months.

Susceptibility

Leucosis and Paralysis is a disease of the domestic fowl; ducks, geese and turkeys are believed to be resistant. In fowls, however, susceptibility varies. Some breeds are more resistant than others. Further in any outbreak not all birds become affected so that variation in resistance between individuals probably exists. It is important to remember also that susceptibility is increased by factors that lower the natural resistance of the birds; for example, the presence of internal and external parasites, other infectious conditions and poor feeding and management.

Essentially it is a disease of young fowls, having its highest incidence in those approaching sexual maturity, or just when they are beginning to lay at about 5-8 months of age. The period of incubation of the disease is long, varying from 1-8 months. It is quite possible therefore that the infection causing disease in young pullets when they are coming on to lay was transmitted in the egg. Birds older than 10-12 months are rarely affected

Diagnosis

Although the description of symptoms given above may enable the poultry farmer to make a tentative diagnosis, it must not be forgotten that any one of the disease conditions mentioned in the introduction and many others, may give rise to rather similar symptoms. In some outbreaks diagnosis is difficult even for trained personnel. The poultry farmer, therefore, who has reason to suspect the presence of this disease, is well advised to seek immediate veterinary advice. Only after accurate diagnosis can proper measures of control be confidently undertaken and the needless waste of time and money in so-called treatments be eliminated.

Treatment and Prevention

As yet no method of treatment has proved satisfactory. A certain amount of success has been claimed for injections of potassium iodide. In some trials this drug has proved ineffective, and in any case it would seem to be a dangerous procedure to keep alive and propagate potential carriers of infection.

Preventive measures include the ruthless slaughter of all sick birds, scrupulous cleanliness, including the daily removal of all droppings, repeated cleansing of the houses and disinfection with caustic soda solution and the use of proper feeding utensils. Young stock or newly purchased stock should be kept on clean ground away from older birds. As far as possible, only birds which have never been subject to infection should be used for breeding, and feeding and management should be such that the natural resistance of the birds is maintained at a maximum.

Owners of disease free flocks should exercise the greatest caution to be sure that they purchase eggs, day old chicks, and other young stock only from flocks which are known to be perfectly healthy.

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ELLESMERE GUARDIAN

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AGRICULTURAL BULLETIN

Modern Farm Tractors and Their Costs

Prepared by the Canterbury Agricultural College, Lincoln

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Introduction

Modern developments in tractor manufacture, although restricted in scope due to recent war demands, have enabled great progress to be made. For example, the use of air tyred and track tractors permits economy in fuel consumption. More efficient conversion of the fuel consumed into work done has occurred through the use of special tractor implements, and the tractors have become much more comfortable and versatile to operate through the increased range of gear speeds and attachments, the development of sprung seats and covers, the use of self-starters and electric lights, etc. Track tractors and four-wheel drive tractors enable the cultivation of land which formerly was too soft, wet or too steep to carry the ordinary type of tractor. Other types of tractors have adjustable wheel width to facilitate inter-row crop cultivation. Machines have been introduced to cover all requirements from the giant gyrotiller, crawler type of diesel tractor suitable for the largest farm and for contract work, to the electric or petrol engine driven lawn mower for the small lawn.

Costs are based on the following fuel prices which include an allowcharges, use of drums, wastage, etc.

Starting Petrol	2/-	per gallon
Kerosene	1/8	per gallon
Crude Fuel Oil	1/1	per gallon
Diesel fuel	1/2½	per gallon
Oil	8/-	per gallon

The average purchase cost of tractors normally increases through petrol-kerosene-type-tractors up to diesel-fuel-tractors and from steel wheel, through rubber tyred up to track laying tractors. On the other hand the number of horse power hours obtained per gallon of fuel used increases as petrol or kerosene fuel is replaced by the cheaper and heavier semi-diesel and full diesel fuels. Where co-operation or other means permits the use of the higher priced diesel type of tractors, then through more economical fuel and economy in man-labour, very low costs per acre of work done may be achieved.

In the following schedule of costs, estimates of purchase prices have been made for the semi-diesel tractor which is not now obtainable and for the diesel air tyred and track tractors which have not been imported for some years. The increase in price of tractors is around 100 per cent on the 1936 prices and 33 1-3 per cent on to the 1940 prices. The others are based on present day actual average costs and average allowances for fuel used under medium to heavy ploughing conditions. All types on lighter work could work at less fuel consumption than shown. It will be noted that where a small amount of light work only is to be done, the lower priced petrol or kerosene air tyred tractors operate at less total cost, but where a large amount of heavy work is to be done the higher priced diesel fuel type of tractor, although operating at greater total cost, operates more cheaply per unit of work done. Where a farmer can do his heavy work by efficient contract labour and his light work by his own power unit the advantages of both power units can be enjoyed.

Makes of Tractors Considered on the Table

In 1919 there were 136 farm tractors in New Zealand, in 1931 there were 5000, by 1942 there were 14,000 and the number is very rapidly increasing. Among these, there are numerous types. The air-tyred, kerosene and semi-diesel, the crawler, air tyred diesel and crawler diesel types of tractors will be considered

in more detail. The various types of tractors are classified in groups as being 2, 3, and 3-4 furrow tractor plough types and the fuel consumption is estimated on the basis of medium to heavy ploughing work. It must be noted that a tractor in a heavy class would be likely to use less fuel on light work. Air tyred tractors normally use less fuel than steel wheel type. Depreciation costs for air tyred types are based on an estimate on account of the fact that since their introduction towards the end of 1935, none of these types have been discarded. Nevertheless a longer life can safely be estimated for these types than for the average steel wheel type. On heavy work the diesel or semi-diesel uses less fuel than the petrol or kerosene types. The semi-diesel uses more oil than the other types and the crawler types use more grease. Petrol types, if specially adapted to high compression fuel theoretically can use less lubrication oil because of the longer number of hours of work done before changing oil and of the smaller size of the crank case to be filled with oil. On light work some petrol type tractors can be geared up to work at higher speeds.

Under the 2-furrow air tyred class are included for averaging purposes Allis Chalmers B & C, Case S, Deere B & BR and International A. and B.

Under the 3-furrow air tyred class are included Allis Chalmers W & WF, Case D, Deere A and AR, International H and W4, and Massey 101. The semi-diesel Lanz bulldog would come into this class if available.

Under the 3-4furrow air tyred class are included Allis Chalmers U, Case LA, Deere D, International M and W6, Massey 101 Snr., Imperial larger and Lanz bulldog.

The 3 to 4-furrow diesel crawler type includes Caterpillar D2, International TD6, Cletrac AG.

The Various Items of Cost

The table set out on page 4 depicts theoretical average normal costs on the basis on which tractors should operate in medium to heavy ploughing work under the conditions of prices and costs and for the hours of work stated. Actual individual costs will vary greatly from the normal quoted according to the particular conditions encountered. Now that tractors are widely used with sometimes two or more tractors on the one farm the actual hours worked per tractor are on the average much less than was formerly the case.

(1) Type of Tractor

In purchasing a tractor the first essential is to buy the type suitable for the work to be done, e.g., for row crop work and inter-row cultivation the rubber, or adjustable width rubber wheel type tractor may be advisable. Models with plough and cultivator attachments fitted to the tractor are becoming available. For light discontinuous short hours of work the rubber tyred tractor burning petrol is likely to be the most convenient. Models with sprung seats and hoods, self starters, electric light, and a wide range of speeds are becoming available. For heavy, continuous contract work, or work on a large farm, the diesel or semi-diesel fuel tractors work more cheaply. For light or heavy work on wet ground and steep country and for the heaviest work the crawler types of tractors are necessary and even on flat, dry country, these types of tractors enable the least compression of the cultivated soil where heavy work is to be done. Overloading of tractors leads to loss of economy. For potato and large-scale vegetable production still newer types of tractors or tractor implements are being introduced. An increasing number of various types of power implements suitable for the small as well as the large farm is also being introduced, e.g., modern types of hay balers, trailer attachments, etc.

(2) Fuel Costs.

The price of petrol and kerosene is relatively high at the moment. Kerosene is costed at 1/8 on farm and petrol costs are based on petrol bought in 44 gallon drums at 1d less than retail price, i.e. 2/8½ less 10d per gallon rebate of road and customs tax allowed by the state where petrol is used for farm tractor purposes and plus 1½d per gallon for freight charges, etc., i.e., 2/8½ - 10d + 1½d = 2/- per gallon. After the state rebate has been received where the petrol is bought at service stations direct, a further reseller's rebate of 1d per gallon can at present be obtained.

Diesel fuels have also risen considerably in price in recent years. The formerly very low priced semi-diesel crude fuel suitable for the hot bulb type of semi-diesel tractor is now available. Costs for the electric power driven cable type of

tractor though not included in the table are similar to the costs for the diesel and the semi-diesel types of tractor. The relative availability and costs of crude fuel, dieseline, kerosene and petrol are very important as they affect the economy of the various types of tractors. Future variation in costs is at present beyond the New Zealand farmers' control.

(3) Oil and Grease Costs.

Extra oil costs for the semi-diesel and extra grease costs for the crawler type diesel have been allowed. Actual costs fluctuate greatly, depending on the care the tractor receives, the abrasive nature of the soil in which the tractor works, and the type and speed of the work done and size of crankcase, transmission case, etc. Costs are estimated on the basis of changing oil each 60 to 120 hours according to makers' instructions as well as adding oil when necessary. Light oil is also used for filling the air cleaners periodically, for flushing, for mixing in the starting petrol and heavy oil for refilling the transmission oil case at least once a year on light work.

(4) Starting Fuel Costs.

In most cases kerosene-using tractors are heated by first working on petrol. Where petrol is used for heating up the tractor prior to using kerosene or diesel fuel for the actual work, extra costs have been allowed. The amount of petrol required for heating the hot-bulb type of semi-diesel will be about half that for kerosene types.

(5) Maintenance Costs.

Maintenance costs include an allowance for one complete new set of air tyres or for repair of tracks. New sets of air tyres fitted will cost from £50 to £110. Repairs and fittings of tracks and accessories will cost around £240. When working in very abrasive types of soil, track maintenance costs may be much higher.

(6) Repair Costs.

Allowance is made for replacement of oil cleaners around each 100 hours or according to maker's instructions, for decarbonising, grinding valves, fitting of new valves as required, fitting of new spark plugs and new gaskets once each year or each second year, and a general overhaul, refitting of pistons or grinding of cylinder walls, tightening clutch plates and brakes once each three or four years. Repair costs for any particular tractor may be lower than set out in the table but they may also be much higher due to accident and careless handling, overloading, over-heating, failure to follow oiling instructions and similar causes. Costs of tractor operation depend largely on the operator's skill, commonsense and the care taken to prevent overloading or overdriving.

Depreciation Costs are based on an estimate. Actual costs for the new types of air tyred tractors are not available as these have not yet been discarded. Estimates are based on a 10,000 hour life. If the tractor is worked for more years or longer hours after this period depreciation costs will be nil since the tractor has been completely written off, but repair and general running, fuel, oil and replacement costs can be expected to greatly increase. In the long run it will pay to purchase a new tractor.

Interest, Insurance and Use of Shed and Cover

The basis of estimates of charges for these items are as shown in the table, with an addition of £5 for the use of shed, tractor cover and sundries.

Total Costs

It should be noted that costs per acre of work done will be much less for the higher powered types of tractors. If allowance is made for man-labour charges, the trend of costs per unit of work done will, under full time working conditions, be almost exactly the reverse of the trend of costs per hour shown in the table. Actual individual costs will vary greatly from the average costs quoted. For example where a high priced tractor is used for only a few hours per year, (e.g., a 4-furrow diesel crawler model for only 100 to 200 hours per year) then a much higher charge of depreciation than shown in the table would probably be required. Conversely where a light tractor is set to do heavier work than that for which it is built not only will fuel charges be likely to increase much more than in proportion, but maintenance and depreciation costs are also likely to increase.

The attempt has been made to set down total costs at the rate at which makers or agents could if this were the selling policy, hire out their

Class	2-Furrow on Rubber	3-Furrow on Rubber	3 to 4-Furrow on Rubber			3 to 4-Furrow Crawler Type	
Cost of Tractor	£400	£500	£850	£600	£800	£850	£1000
Fuel consumption per hour	1 gallon	1½ gallons	1½ gallons	2 gallons	1½ gallons	1¾ gallons	1¼ gallons
No. of hours used per year	600	1200	1500	1500	1500	1500	1500
Fuel used	Kerosene	Kerosene	Semi-diesel	Kerosene	Dieseline	Kerosene	Dieseline
Total fuel gallons	600	1800	2250	3000	2250	2625	1875
Cost £	£50	£150	£121	£250	£136	£219	£116
Oil gallons	12	25	50	50	50	50	50
Cost £	£5	£12	£20	£20	£20	£20	£20
Grease gallons	4	5	7	7	7	30	30
Cost £	£2	£2	£3	£3	£3	£13	£13
Extra starting petrol cost	£1	£3	£4	£5	£13	£5	£13
Total running costs and per hour	£58 1/11	£167 2/9	£148 2/-	£278 3/8	£172 2/3	£257 3/5	£162 2/2
Maintenance based on 10,000 hr. life.	£12	£20	£30	£30	£45	£70	£90
Depreciation based on 10,000 hr. life.	£24	£60	£127/10/-	£90	£120	£127/10/-	£150
Interest at 5%. Ins. at ½% on ½ new cost + £5	£16	£19	£30	£22	£27	£30	£33
Total overhead costs and per hour	£53 1/9	£99 1/8	£188 2/6	£142 1/11	£192 2/7	£228 3/1	£273 3/8
Total all items and per hr.	£111 3/8	£266 4/5	£336 4/6	£420 5/7	£364 4/10	£485 6/6	£435 5/10

NOTE—Although the above figures are set out in table form, the data cannot be compared horizontally. As total costs increase costs per acre of work done are likely to decrease. To make valid comparisons would be as impossible as to decide under changing conditions of invention and work to be done that an Austin 7 was cheaper than a Morris 8, Austin 10, or 14, Ford V8, Chevrolet, Buick or Dodge, etc. See notes following.

tractors to reasonably careful users and cover risks, working costs, repairs and interest costs for the tractor. Under commercial conditions a slightly higher charge per hour would probably be made to cover all contingencies.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.

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CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

TUSSOCK GRASSLAND

Prepared by the Canterbury Agricultural College, Lincoln.

Bulletin CHRISTCHURCH, JULY, 1944. No. 180.

Tussock grassland covers about 14 million acres in the South Island on the eastern side of the main divide extending from the Wairau river in Marlborough to the forested areas in Southland. There are two main types of tussock grassland; (a) the dry-land treeless areas where the effects of burning are serious and where the effect of rabbits is pronounced; (b) the high rainfall areas where burning is often necessary to prevent return to scrub, fern or bush and where rabbits are not usually as serious a menace as they are on the dry-land areas. Between 80 and 90 years ago most of the area was occupied and divided into huge grazing runs whose boundaries were the main rivers or range tops. In more recent times, some subdivision has been effected but the runs are still held in large blocks ranging from about 5,000 acres to 100,000 acres or more. The smaller runs are usually located on the better classes of land in warmer areas and may carry up to one sheep to two acres. The larger runs are usually found towards the main divide on poorer, colder and more dangerous country. The carrying capacity of these runs including shingle slopes and some barren land averages about one sheep to five acres.

In contrast to the rest of the farming lands in New Zealand the tussock grassland areas are, superficially, in the same condition as they were when the land was first occupied nearly 100 years ago. In the interval they have provided grazing for between 2 and 3 million sheep each year and except for the depleted areas in Central Otago this grazing has had little outward effect on them. No striking change in the management of this country has taken place except that the Merino on many runs has given place to the half-bred and Corriedale. A certain amount of fencing has improved the grazing management. Wool is the main product. Dry sheep produce more wool than breeding ewes and the clip averages about 6 to 8 lbs. per head. On the hardest country only about 1 breeding ewe to 2 dry sheep can be carried. The lambing averages about 65 per cent and the death rate from 5 per cent to 20 per cent. Thus an estimated carrying capacity of 12,000 adult sheep would consist of 8,000 dry sheep (wethers and dry ewes), 4,000 breeding ewes and 2,600 hoggets of which 1,300 would be ewe hoggets from which breeding ewes would be chosen. On the better country the proportion of breeding ewes to dry sheep may be as high as three to two; up to one breeding ewe to two thirds of a dry sheep may be carried and then the sale of surplus store sheep becomes an additional major objective. On runs where there are flat swampy areas and where fencing is adequate, cattle are also carried and provide an additional source of revenue.

Snow Risk.— From late autumn to mid-spring heavy snowfalls are frequent on the high country. Before the onset of the winter snow the sheep must be mustered down to lower levels. Here they have access to snow-free grazing except in bad snow years when the snow may lie for weeks on end. On many of the high runs heavy losses, sometimes up to 50 per cent of the flock, are experienced at irregular intervals. When a succession of these bad years occurs the run holder loses, not only on account of actual deaths, but also on account of reduction in stock carried during the several succeeding years until stock numbers are built up again which in

itself is a serious problem.

Management.—The sheep are mustered down from the tops of the hills sometime in April or May. They spend the winter on the safer and warmer "winter country." This has generally been spelled since September and the grasses have had an opportunity to flower and set seed. On runs where ploughable land occurs turnips or hay may be grown to supplement the feed on the winter country and in some degree this practice has been responsible for the maintenance of the carrying capacity of runs. After the risk of heavy snows is past the sheep are driven off the "winter country" onto the higher levels or "summer country." Where the summer country is fenced off from the winter country the problem of grazing management is simplified, but on many runs the expense of fencing maintenance has prevented this being done and repeated mustering is necessary to keep stock off the winter country as long as possible.

Labour.—The labour position on these runs is presenting difficulties at the present time. The shepherds and musterers require to have a sound knowledge of the country and in most cases this is acquired only after years of working experience. Blade shearing is almost universal. Skilled labour for both mustering and shearing is in short supply and high wages must be paid for the right type of man. On other types of farms the labour problem has been met to some extent by mechanisation but little use can be made of machinery in the tussock grassland type of farming, except, perhaps, in the matter of transport.

Management Practices

1. Spelling.—Spelling is a powerful agent in efficient management. As previously indicated there is a division into "summer" and "winter" country. The "winter country" is most intensively grazed when the plants are dormant. The "summer" country is normally grazed when the snow has disappeared, i.e., in summer when the grasses and herbs are growing, flowering and seeding. It is suggested that where practicable, portions of this country should be spelled once in 3 or 4 years to give the vegetation a chance to reseed and regain its vigour.

Most of the "winter" country should be spelled from December to April. Winter grazing when the plants are dormant does not injure the vegetation to the same extent as grazing in spring and summer and where "winter" country is regularly spelled the plants retain their vigour. Relative freedom from deer and rabbits is necessary for effective spelling.

2. Burning.—This has been an established practice since the runs were first taken up. Overburning, especially of dry faces and in the dry seasons has been one of the major causes of deterioration. The Royal Commission in 1915 and Dr. L. Cockayne, as a result of his investigation from 1918 to 1925, warned runholders of the evils of haphazard burning. The evils of overburning are now well recognised. Burning is still a necessity for clearing scrub and fern prior to surface sowing, to clean up rank growth on the cold shady faces and perhaps to avoid the risk of uncontrolled summer fires caused by careless campers or tourists who by throwing away lighted cigarettes and unextinguished matches have been responsible for many fires.

When burning is undertaken it is necessary—

(a) To burn in the spring after rain or snow before the butts of the tussocks have dried out.
(b) To refrain from burning the same area too frequently.

One of the practices which is most harmful is to burn for the purpose of providing a green bite for the sheep. This gives a double check to the plants, not only to the palatable ones growing in the shelter of tussocks, but also to the tussocks themselves. The burning gives the first check and then a month or so later when the plants have spent their energy in developing new leaves, these are eaten off before they have a chance to develop fully. It is this second check which often causes the plants to die. This practice was once widespread because the fresh growth from the tussocks was eaten by sheep whereas the older leaves are not eaten and the owner thought he was not doing any harm. This practice, more than the burning has been responsible for a great deal of the damage which has been attributed to burning.

The Chief Plants

The tussocks are the characteristic plants.

1. Fescue tussock. (Festuca novae zealandiae).—This is the most common tussock, especially on the poorer land. It has fine erect leaves which feel slightly rough to the touch when the hand is rubbed from the top towards the base. This is not to be confused with Nasella Tussock which is a courser plant with much rougher leaves. It is unpalatable except in the young stage, but the seed heads are eaten by sheep, horses and cattle.

2. Poa tussock: (Poa caespitosa), often called the silver tussock. This will always be found on better land than the fescue tussock. Its leaves are broader, more drooping and quite smooth to the touch. The tussock is unpalatable to sheep but they eat the seed heads. Cattle will eat and pull out the leaves, especially the younger ones.

3. Small blue tussocks: (Poa Colensoi and Poa intermedia).—These tussocks are much smaller and finer in the leaf than the fescue and Poa tussock and have a bluish tinge. In certain areas they appear to be palatable, but in other areas they are not. The seed heads are short and delicate and are not of much food value.

4. Snow grass: (Danthonia Raoulii) (an oat grass).—This is a tall coarse tussock 2-4ft. high usually found above 2500ft. in Canterbury and at lower levels in Southland. The leaves are not palatable but the seed heads are readily eaten by cattle. The grass provides shelter for herbaceous plants and is of great value in snowstorms as a protection for stock and also provides a meagre diet when sheep are snow bound.

5. Blue grass: (Agropyron scabrum).— This is a New Zealand cousin of the American crested wheat grass. It must not be confused with the small blue tussock. It is one of the palatable grasses and is rarely seen where stock are grazing, except in the centre of one of the unpalatable tussocks. The seed stalks are very long and droop over the top of the tussock and bear a few seeds with wavy awns, 1½in. long. The leaves are broad and flat and have a bluish tinge.

There are numerous other plants, grasses and herbs, which are inconspicuous but which contribute most of the feed for stock. The majority are natives—the small Danthonias and Poas and some daisies as well as the native brooms and other shrubs; others are introduced, the most important being cat's ear, sorrel, yorkshire fog, sweet vernal, Poa pratensis, Chewings fescue and brown-top. White clover, cocksfoot, dog's tail, and timothy occur on shady and more fertile areas. The amount of feed produced by these plants, including the seed of the tussocks, is not large but on country supporting about one sheep to 2½ acres of grazing land only a small amount is required per acre.

Surface Sowing

In 1920 Dr. L. Cockayne established surface sown areas in Central Otago. In 1935 R. B. Tennent after a study of these areas reported the following plants as being most successful where the seed had been trampled in by sheep and the plants, by spelling, had been given 18 months to establish before stocking: Lucerne, cocksfoot, tall fescue, chewings fescue, chicory and yarrow. In 1944 G. Calder reported the results of some further work in Central Otago. The following plants established after two years spelling: Lucerne and tall oatgrass; cocksfoot; blue wheat grass; Poa pratensis; Danthonia pilosa; subterranean clover; yarrow and Chewings fescue and crested wheat grass in that order.

It is admitted that extensive sowings of these plants is not practicable on many areas but the knowledge that these plants can establish and grow under tussock grassland conditions will give those who can undertake the work confidence in the selection of suitable plants.

Deterioration

It is generally accepted that the carrying capacity of tussock grassland is deteriorating and this is most obvious in the regions of low rainfall where the tussock has disappeared and scabweed is practically the only vegetation which exists. In 1915 a Royal Commission which was appointed to investigate the problems associated with the runs concluded that deterioration was widespread and was more severe in dry districts. The following reasons were given:—

1. Burning, especially in the wrong season.
2. Over-stocking with sheep.
3. Continuous grazing for over 70 years with no improvement attempted.
4. Allowing rabbits to become numerous.

5. Unsatisfactory conditions of tenure.

From 1918 to 1925 the late Dr. L. Cockayne carried out an investigation of the tussock grasslands and established experimental plots in Central Otago. Spelling and surface sowing were investigated. In 1938 V. Zotov made a botanical survey and in 1940 R. D. Dick investigated the effect of grubs on tussocks.

These investigations and reports have been valuable in drawing attention to defects in management and to other causes of deterioration. To correct major faults some action has been taken by run-holders and by Government Departments concerned but the extent and continuity of the investigation and the amount of improvement effected are inadequate when consideration is given to the importance of this vast area of country.

Carrying Capacity

It is not easy to show marked reduction in carrying capacity except on the most devastated areas, e.g., one run in Central Otago carried 70,000 sheep in 1879 and only 20,000 in 1914. In a district of moderate rainfall the stock numbers on 3 runs with records extending over a period of 60 years are presented.

	1879	1889	1899	1909	1939
Run 1	18,000	21,500	22,500	20,000	21,000
Run 2	8,500	8,500	8,500	7,000	5,000
Run 3	18,000	32,000	31,000	32,000	24,000

These figures give a picture of individual variations which have occurred. Run 1 appears to have maintained or increased its carrying capacity; Run 2 was apparently overstocked for the first 30 years; the stocking for 1939 is considered adequate under present conditions; Run 3 was overstocked from 1889 to 1909 but is still carrying more than it did 60 years ago.

Up to 1909 the stock carried were mostly merinos. By 1939 a general change to half-breds had occurred. Since more merinos than half-breds can usually be carried there is evidence of a general increase rather than reduction in carrying capacity.

The Mackenzie county is one in which deterioration in certain areas is marked. Over 90 per cent of the area is in tussock. The number of stock carried since 1884 is shown below:—

1884—422,000	1914—495,000
1887—440,000	1919—540,000
1893—442,000	1925—492.000
1899—394,000	1929—570,000
1904—399,000	1934—558,000
1909—471,000	1939—592,000

Two other counties which have over 96 per cent of their area in tussock show a similar trend.

	Tawera	Lake
1912	78,000	242,000
1915	97,000	238,000
1918	99,000	250,000
1920	90,000	———
1925	99,000	262,000
1927	92,000	269,000
1930	118,000	321,000
1933	109,000	314,000
1936	110,000	245,000
1939	111,000	297,000

The above evidence causes one to seek an explanation of this increase in carrying capacity. Several factors have operated, some of which are more applicable to some runs than to others, e.g.:—

1. Better management along the lines of the investigations and reports previously mentioned.
2. Better control of burning.
3. Control of rabbits.
4. Subdivision of runs.
5. Provision of winter feed on the run.
6. Wintering hoggets or ewes off the run.

Most of these practices involve increasing costs which are attempted to be met by carrying more stock. When costs are too high in relation to the returns the most difficult country is abandoned. For some time past there has been a steady abandonment of the more marginal runs. Apart from loss of production there is a grave danger, in such abandonment, of the spread of rabbits and deer as well as briar, gorse and other weeds.

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

TOOLS FOR THE FARM WORKSHOP

Carpenters' and Engineers' Tools

Prepared by the Canterbury Agricultural College, Lincoln.

Bulletin CHRISTCHURCH, AUGUST, 1944. No. 181.

The constant need for repair jobs on a farm calls for the use of tools.

What Tools Are Necessary

There are two main classes into which workshop tools may be grouped: Carpenters' tools and engineers' tools. The number of these tools found on farms varies from the comprehensive set of the man who has a "flair" for repair work to the meagre few of those who prefer to let the minor repairs go and to hire labour for the bigger jobs.

In the accompanying illustrations a suggested collection of tools is represented. The use of the forge, blacksmith's, fencing, and other tools will be discussed in later bulletins.

At the outset let it be said that few farmers may be prepared to buy such a collection of tools at the present time owing to their high cost; but the gradual purchase of them over a few years is well worth considering so that eventually there is built up a tool kit which will be of both use and satisfaction to the owner.

1. Carpenters' Tools

These need not be numerous but they should be of good quality; good work cannot be done with poor grade tools.

Saws: A rip saw and a handsaw as shown may be augmented by the addition of a keyhole saw with detachable blades, to which a pruning saw blade can be fitted for work in the orchard. At regular periods the saws should be taken to town to be set and sharpened. This ensures their easy working without forcing and consequent strain or buckling.

Planes: Two planes at least are required—an iron or wooden smoothing plane and a wooden "Jack" plane, which is handy for taking the "rough" off sawn timber prior to putting a finish on with the smoothing plane.

Chisels: These may be bought in a great variety of widths but the most useful sizes are ½in., ¾in. and 1in. widths; as shown in the illustrations a heavy 1½in. chisel may be included where a robust tool is required. The fitting of the head of the handle with a brass ferrule is an advantage.

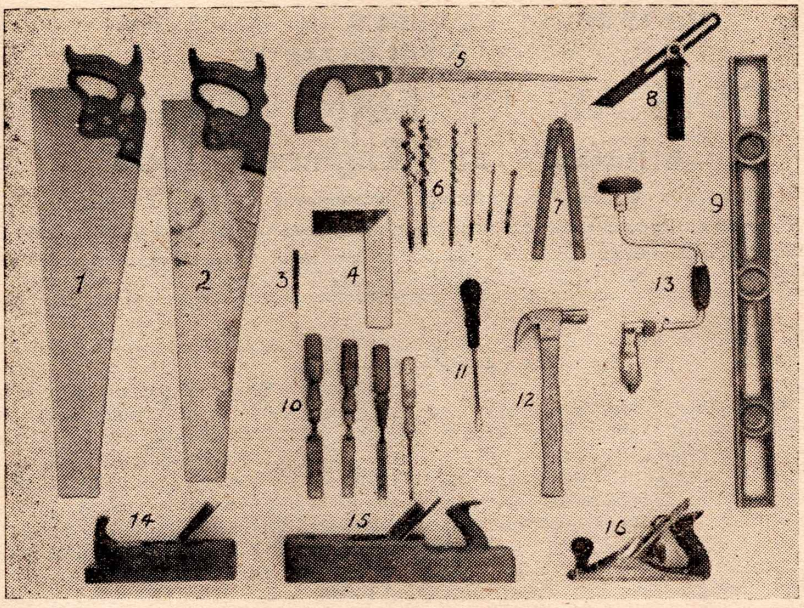
Brace and Bits: A good strong brace repays the cost. The type shown, a ratchet brace with 5in. throw, makes it possible to bore holes in awkward positions. Twist bits are made in all sizes but the most used are those shown ⅛in., ¼in., ½in., ¾in., and 1in.

Screw driver bits are a useful addition as they can be worked with greater "purchase" than the standard screw driver.

Spirit Level and Squares: In order to work "truly" these tools are essential. The level may be made of wood or aluminium and is fitted with glass tubes almost entirely filled with alcohol in which is a bubble of air. These tubes, one on the long edge and one (or two) near the end provide the means of testing horizontal and vertical surfaces.

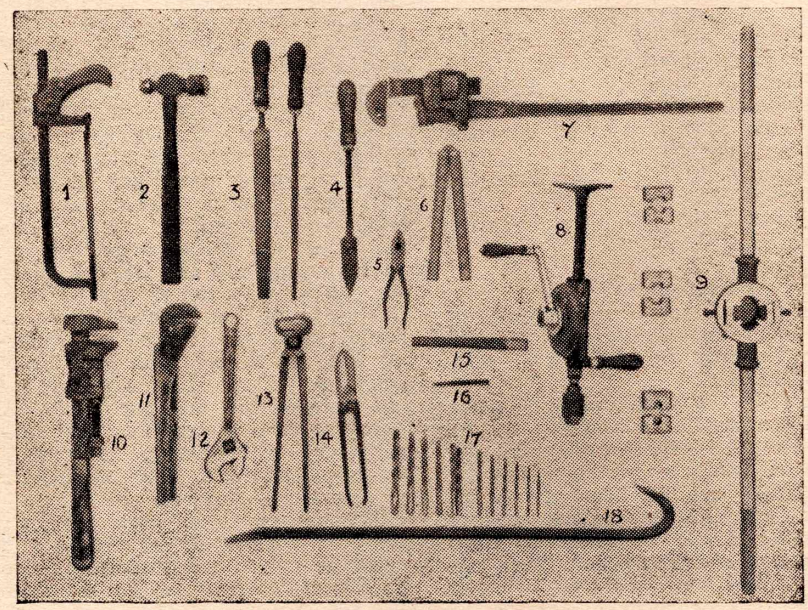
The try-square is used for squaring ends of timber. The long blade should be 9in. to 12in. long and the tool should be strongly made. A faulty square is useless. The sliding bevel is necessary for setting out bevelled work. It is adjustable for any angle required.

Miscellaneous: The claw hammer, rule (3ft.), screw driver (12in.) and punch shown in the illustration are those mainly required to complete the set, but the number of tools may be increased almost indefinitely. Such other common additions as the marking gauge, straight edge bradawl and tenon saw are generally useful in addition to those listed above. In order to work with these



CARPENTER'S TOOLS

1. Rip Saw. 2. Hand Saw. 3. Punch. 4. Square. 5. Keyhole Saw. 6. Bits. 7. 3ft. Rule. 8. Sliding Bevel. 8. Spirit Level. 10. Chisels. 11. Screw Driver. 12. Claw Hammer. 13. Ratchet Brace. 14. Jack Plane. 15. Wood Smoothing Plane. 16. Iron Smoothing Plane.



ENGINEER'S TOOLS

1. Hack Saw. 2. Hammer. 3. Files. 4. Soldering Iron. 5. Pliers. 6. Rule. 7. Stillson Wrench. 8. Breast Drill. 9. Stocks and Dies. 10. Shifting Spanner. 11. Footprints. 12. Crescent Spanner. 13. Pincers. 14. Tin Snips. 15. Cold Chisel. 16. Centre Punch. 17. Drills. 18. Wrecking Bar.

tools a solid bench, to which a strong vyce it fitted, and which is well lighted, is necessary. The bench is usually made of 4in. x 2in., or 4in. x 3in. frame with 2in. deck timber, about 6ft. or more in length, 2ft. 6in. in width and up to 3ft. in height.

Tool Rack or Tool Box:

All tools should be stored in racks or in a box constructed specially to hold them. The former method is most suitable for farm use as the tools rarely have to be taken away from the work shop. The first job should be to construct such a rack and the most convenient type is a wall rack—either on the wall of the shed itself or on a specially erected board over the work bench. Tools should be hung up in groups or held in racks which will enable the worker to take them down readily. It is a good plan to outline them in paint on the board behind the actual position of the tools so that one can see at a glance if any are missing. This "shadowing" may take a little time but it is well worth while. More damage is done to tools through careless storage than through any other cause. If they are not likely to be used for some time the metal work should be given a light coat of lubricating oil or grease to protect them from rust; so treated and racked they will serve well and usefully for years.

Sharpening:

Saws, chisels and planes need periodical attention to keep their cutting edges up to the mark. Saw setting and sharpening is a tricky job and may best be done by a "saw doctor" in town unless one is well versed in the use of saw set and file. Amateur efforts in this respect can render the best of saws useless and should not be attempted. Chisels and plane irons can be "touched up" on the oil stone by anyone who appreciates the need of careful work. Unless "gapping" has resulted from the edge striking on metal, the sharpening requires the observance of a few main principles, as follows:

The oil stone should be thoroughly cleaned with a rag and then covered with a thin layer of light lubricating oil. The chisel should be held at the correct angle so that the bevel is flat down on the surface of the stone, then slightly raise the iron so as to increase the angle from the bevel to the "sharpening angle." The iron should be run over the stone with firm pressure and even strokes until a slight burr can be felt on the back of the cutting edge. The iron is then turned over and run lightly over the stone, keeping the iron perfectly flat, until the burr disappears. The sharpened iron may be finished off by stropping the cutting edge on a broad leather strap fastened to a piece of wood similar in size to the oil stone. The edge should be tested with the thumb to determine that it is keen but free from any trace of "wire edge."

Plane irons are sharpened in much the same way, with this difference. The iron is finished off by turning slightly so as to apply greater pressure towards the two corners of the cutting edge in turn. This gives the face of the cutting edge a slightly convex finish which allows it to be worked without the corners of the blade protruding from the mouth of the plane and so leaving a ridge on the dressed surface of the timber. The backing iron of the plane should be screwed firmly and accurately down on the blade of the cutting iron, thereby preventing the shavings from being caught up and blocking the plane.

Grinding:

After a time the angle of the cutting iron becomes so great that it no longer retains a keen edge or the edge may become "gapped." It should then be ground so as to restore the angle again. This should be done either on the grindstone or the carborundum wheel. Of the two, the grindstone is to be preferred as careless grinding on the carborundum is liable to destroy the temper of the steel. The grindstone should be run in a water bath, turning towards the blade to be sharpened. During grinding the iron or chisel should be held firmly at the correct angle and moved slowly from side to side across the face of the grindstone so that an even surface will be maintained. Normally it is necessary to grind out the sharpening bevel only, but where gapping has occurred deeper grinding is necessary. In this case the trueness of the cutting edge should be checked by means of the try square as the grinding proceeds.

Where a carborundum stone is used the speed of rotation should not be too great and it is as well, as grinding proceeds, to cool the tool being sharpened in water.

Bits: The sharpening of carpenters' and also engineers' bits and drills to give efficient cutting is difficult to describe without demonstration, and when opportunity offers a mechanic or carpenter should be asked to demonstrate the correct method. These tools are best kept in a drill stand made by drilling out correct size holes to receive the shank in a wooden or steel block.

2. Engineering Tools

As with carpentry, the carrying out of minor engineering jobs can be done with much saving of time and expense on the farm provided the workshop is reasonably well equipped. Fig. II shows a series of tools adequate to carry out most of the work likely to arise, though, as previously stated, this range may be greatly widened with the individual's fancy for undertaking engineering repairs on a more ambitious scale.

Spanners and Wrenches: Those most essential are: The Stillson wrench, which is valuable for the screwing up or unscrewing of pipe junctions. The type of the jaws and the long handle provide strength and purchase which no other wrench can equal. It should be used on bolts and nuts only as a last resort to loosen them when seized up. Shifting spanners may be of two types, the ordinary adjustable spanner or monkey-wrench, and the crescent type; both are designed for use in tightening the ordinary range of bolts and nuts found in farm machinery. The "Footprint" pipe wrench is a valuable tool for pipe work and gripping where the Stillson wrench is too cumbersome. It is so made that the jaws can be set to any desired width within the range of the tool. These tools are all obtainable in a wide range of sizes.

The Hacksaw is a most useful tool for cutting metal. The saw should be adjustable to take 8in. to 12in. blades and should be of a simple, strong type, preferably with pistol grip. Blades should be of the "soft back" type, 10in. blades with 18 and 24 teeth per inch, for cutting thick and thin work respectively, being most useful.

Drilling:

The Breast Drill and a set of twist drills are useful for metal drilling. The drill should be of a good strong type with two speeds. Other useful but more expensive types are the hand wall or bench drilling machine and the chain or post ratchet drill. The drills may be procured in a wide range, those shown ranging from $\frac{1}{8}$in., increasing by 1/16in. intervals up to $\frac{3}{4}$in., and are sufficient to serve all normal needs.

Files may be procured in a wide variety of shapes and sizes and grades of cut. The 12in. flat bastard file is useful for a range of jobs while the round or half round serve for any work where curved surfaces need to be enlarged or trued up. One or two triangular and square files are also useful.

Pliers and Pincers of the types illustrated should be included, also possibly a pair of long-nosed pliers. These should be of good quality; many cheap types are on the market but the saving in their purchase is more apparent than real.

Tinsmithing:

For this work the tin snips and the soldering iron are included. The soldering iron may be heated easily with a kerosene blow lamp or in the blacksmith's forge, while an electric soldering iron of heavy type is very useful.

Chisels and Punches:

Cold chisels for cutting metals and cutting heads off rivets and rusted bolts, the centre punch for centre punching preliminary to drilling, and a set of engineers' pin punches for removing cotter pins, taper pins, rivets, etc., should form part of a tool kit and to work with them is the 2lb. engineers' hammer with its flat face for straight work and the rounded head for rivetting. A heavier hammer is also useful.

The Pinch Bar of the type shown is an excellent tool where wrecking work is to be done. It should be at least 3ft. long and made of 1in. steel sufficient to stand heavy strains whether one is using the straight or the curved end.

Stocks and Dies: This "set" of tools may be included or not as one desires. A good set of whitworth stocks and dies from $\frac{1}{4}$in. to 1in., and pipe stocks and dies from $\frac{1}{8}$in. to 2in. are invaluable where it is intended to thread metal for either bolts and rods or piping. The expense of this item is high and it is hardly warranted unless sufficient work is done to justify the outlay.

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

RABBITS AND THEIR CONTROL

Prepared by the Canterbury Agricultural College, Lincoln.

Bulletin CHRISTCHURCH, SEPTEMBER, 1944. No. 182

All farmers are aware of the damage done by rabbits on New Zealand farms and sheep runs. These pests make their presence felt most seriously in sheltered waste areas such as river-beds and on the warmer winter blocks in the high country where conditions of temperature and feed supply are suitable for their rapid reproduction.

Not only are they destructive feeders but they materially assist in accelerating erosion in hill country and their presence, where burning of tussock is practised, makes them a real menace.

Extermination of rabbits is the aim of every farmer but under conditions existing today his main efforts are directed towards some form of control. This is particularly true of the back country where there is abundant natural cover for rabbits and where labour, adequate for their destruction, is not available, and where rabbit fencing is impossible.

Nature plays an important part in control where snow lies on the ground in a frozen condition and covers the food supply sometimes for weeks in winter. Heavy rains during the breeding season may fill the burrows with water and drown litters of rabbits too young to escape. Combined with these influences which are effective only on rare occasions there is the constant work of natural enemies of the rabbits such as stoats, ferrets, cats and hawks.

It is the purpose of this bulletin to outline some of the methods that may be used in the control of rabbits.

Fencing

Where rabbits are to be controlled or exterminated it is desirable that the boundary fences should be rabbit proof so that reinfestation from neighbouring areas is prevented. In attempting to clean up a large area it is necessary to tackle one block at a time.

Encouragement of the Natural Enemies

Stoats, ferrets, wild cats and hawks concentrate on rabbit infested areas, and destroy large numbers of rabbits in maintaining themselves and rearing their young. A mature stoat will destroy on the average one rabbit a day while a cat rearing a litter of five kittens has been known to destroy up to four young rabbits a day. It is, therefore, to the benefit of the farmer to encourage the activities of these predators. Unfortunately, there is a high market price existing for skins of cats and ferrets and the professional rabbiter takes every advantage of these high prices. His main idea is to make money and to ensure that there will be rabbits for him to catch the following year. To reduce the destruction of these natural enemies it would seem a step in the right direction if the sale of ferret and cat skins were prohibited.

Trapping

This method is popular because it enables the rabbiter to sell the carcase as well as the skin. The successful trapper must have a sound knowledge of the habits of the rabbit and this knowledge is only acquired by actual experience in the field. In some seasons the rabbits are more easily trapped at burrows while on other occasions better results are obtained by setting the traps at places where they set or scrape, or at tracks in grass and holes in netting fences. A man is fully employed to set 120 traps a day on hill country or 160 on flat country — allowing for the time

spent in taking his catch to a depot for collection. As a general rule a trapper can catch more rabbits over a year than a poisoner can obtain by poisoning alone, but when the ground becomes frozen, trapping in the high country becomes difficult or impossible.

Poisoning

During the winter months poisoning is the best method of destroying rabbits. Good results can only be obtained with poison if the normal food is in short supply, because then, and only then, can the rabbits be tempted to take bait; hence the practice of poisoning in June, July and August, and in some cases during a very dry autumn.

The area to be poisoned should not be disturbed prior to baiting and all sheep should be removed from the area; operations should commence not earlier than the month of May. The lines along which the bait is to be spread are sometimes ploughed with a hillside plough, but if the rabbits are really hungry this preparation is of doubtful value—merely spreading the bait along a line being sufficient. The distance between the lines should be about 100 yards.

The baits commonly used are turnips, carrots, and oats and are usually prepared as follows:—

Turnips should be cut with a hand operated turnip cutter into pieces ranging from 2in. to 3in long, one third inch wide and about a quarter-inch thick.

Carrots: These should be sliced with a knife as the rabbiter rides along—pieces about the same size as for turnips.

Oats should be fed in the dry state or after soaking in water for 24 hours. In certain districts it may be advisable to sweeten the oats and water mixture with 2lbs. of molasses or treacle added to each 15lbs. or kerosene tin of the mixture and boil until soft.

The first bait should be spread at the rate of a small handful every three yards and should not be thrown on dung heaps or on wet shady areas. A good load for a horse carrying a rider is about 8 kerosene-tins-full of turnip or carrot and for the same area two tins of oats will be required.

The rabbiter should not be discouraged if all the bait is not eaten the first night as it sometimes happens that the rabbits will wait for periods of up to a fortnight before taking the bait; it is essential to wait until all this first bait is eaten before continuing with the second, and the second must be eaten before the third is put out. If the bait is eaten one night and left the next the rabbiter must exercise patience, and wait until the rabbits become sufficiently used to the bait to eat all of it each night for three nights in succession and then he will be able to poison. These considerations apply equally in the feeding of turnip, carrot and oats and neglect to observe them will give disappointing results. Once a failure in taking the poisoned bait has been sustained on a particular area there is little chance of success at a later date that season.

Poisoning of the Bait

Strychnine powder is commonly used and is most effective. It is used at the rate of 1oz. per kerosene tin full of prepared turnip, carrot, or oats. The bait is spread on a sheet and the strychnine powder sprinkled over it, then the whole mass is stirred up and again sprinkled with powder. This process is repeated until all the powder is used and evenly distributed over the bait. When turnips are used for this purpose the skins must be removed before cutting so that any poisoned bait not eaten by the rabbits will decompose quickly and not remain to be a danger to sheep when they return to the area. Dry oats should be wetted by immersion in water for a few minutes before treating.

Amount of Poisoned Bait to Use

One kerosene tin-full of the poisoned bait will be sufficient for an area on which the rabbits were eating an amount equal to 8 kerosene tins full of unpoisoned bait. Where rabbits are very numerous a good kill per ounce of strychnine used should be about 300 and variations from this figure are usually due to under-feeding of the rabbits when baiting, feeding fresh bait before all of the previous bait has been eaten, or poisoning before all of the unpoisoned bait has been consumed.

It is worth while noting that poisoning on snow is not possible as the rabbits will not attempt to eat bait which is thrown out on snow even if they are starving.

Precautions

Saddle pack bags used for carry-

ing bait must be clean. Bags used for collecting dead rabbits must not be used for carrying bait. Separate bags must be used for carrying the poisoned bait and should be destroyed at the end of the season. During the whole period of baiting and poisoning, and for a week afterwards, sheep should be kept off the area. All poisoned rabbits should be "gutted" and the viscera buried because the liver and stomach are poisonous to dogs although the carcase is not. The poison should not be put out until nearly sundown because, if rabbits are poisoned before nightfall, the skins are often ruined by hawks. The rabbiter must exercise great care when handling strychnine or the poisoned bait and must wash his hands thoroughly when the work is completed. Tins of strychnine should be clearly labelled as to contents.

Fumigating

This method is practised on farms where it is possible to fumigate all the burrows with a poisonous gas. Proprietary materials are obtainable with a full list of instructions for their use and the most effective are those producing cyanide gas or sulphur dioxide gas. The rabbits are driven into their burrows by dogs wherever possible, then the material which gives rise to the gas is placed in the burrow, the entrances to which are carefully blocked with soil. The success of this method depends largely on the complete sealing of the burrows and the best time for the use of gas is after rain when the wet soil prevents an escape of gas by diffusion into the soil air spaces.

Having obtained the rabbits by the methods outlined as well as by ferreting, shooting, etc., the rabbiter must then skin them and prepare the skins for market.

Skinning

It is in the interests of the rabbiter to remove as much of the skin as possible. He must skin the hind legs right out to the pads of the feet and remove the skin as far up the neck and close to the head as possible. An experienced man should be able to skin 120 rabbits in an hour.

The next operation is the removal of fat from the skin for if this is not done there will be a reduction in price. Fatty skins become damaged due to the melting of the fat when passing through tropical areas on their way to overseas buyers. After the fat has been removed the skins are stretched on wires which have the shape of a hairpin, the arms of which are about a foot in length. The skin is pulled over the wire so that the neck-edge fits tightly over the apex of the bend. One leg of the skin is then pulled and threaded onto one wire end and the overlapping piece wound around the wire. The other leg is pulled down and threaded onto the same wire end. The tail, still on the skin, will be against the other end of the wire. If the skin is stretched in this way it will not slip up the wire and will dry so that a maximum of skin area is exposed. After threading one skin on the wire another skin is placed over the apex and another wire threaded through the loop of the apex and the second skin stretched on the second wire as with the first skin. This enables the skins to be suspended in pairs along a fence for drying. When dry, the skins are removed from the wires, packed into bundles of 100 and sent to auction.

With the subsidy applied during the breeding season rabbit skins are worth at the present time, about £4 per hundred and in the winter they reach as much as £9 per hundred after the 20 per cent Government levy and Social and National Security tax have been deducted. In the autumn of this year rabbits sold to freezing companies returned 3/6 a pair to the trapper and a man, by hard work and long hours, setting 120 traps a day was able to earn about £7 per day.

It has been suggested that with existing prices rabbit farming instead of rabbit extermination should be the farmer's aim. Certainly, in the rabbit infested back country sheep runs where there are serious snow losses in the sheep flocks, rabbit farming would be attractive if the high demand and high prices for carcases and skins remained steady over a period of years. There would be no capital required for stock, the cost of production of skins and carcases would be low and that constant fear of ruin by a bad snowfall would no longer exist. However, the main objective should be extermination of rabbits in New Zealand and to that end attempts to farm rabbits must be discouraged. Isolation of the suggested rabbit farms

would be impossible in the back country and rabbits from these areas would be a constant menace to farms where extermination is being attempted.

Summary

To ensure security from reinfestation of the farm by rabbits from neighbouring farms it is essential that the boundary fences should be rabbit proof.

The natural enemies of the rabbit —stoats, ferrets, cats and hawks should be encouraged in their work of rabbit destruction.

Trapping is the most effective method of destruction during the late spring, summer and autumn where rabbits are very numerous.

Poisoning should be attempted only when ordinary rabbit feed is in short supply if best results are to be obtained—during the winter period, June, July and August, or during autumn under very dry conditions.

When rabbits have been reduced in number the area should be cleaned up by fumigating burrows, ferreting and dogging.

Careful attention to preparation of skins for market is necessary if highest prices are to be obtained.

Having commenced his rabbit extermination campaign the farmer should aim at continuous effort over the whole year or years. If he relaxes, the rabbits will increase in numbers during the resulting period of freedom and his efforts will result in some degree of control, not in extermination.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.

ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

Fundamentals of Wool Classing

Prepared by the Canterbury Agricultural College, Lincoln.

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Of all our agricultural products, wool is by far the most exacting in its marketing requirements. Unlike butter-fat or meat, it requires to undergo a long and intricate routine of processing before it can be of direct service to man. Very few wool producers are familiar with even the most elementary facts about the processing of their product and, in contrast with other farm products, only minute quantities of wool are utilised by farmers at home, or by organisations with which farmers are closely connected. Nearly all of our wool, about 97 per cent in fact, is sold to overseas users and exported. Because of geographical separation from centres of wool manufacture, the wool grower is not well informed about the principles which should underlie the handling of the clip between the sheep and the broker's display floor. Certainly, over a period of years, our wool brokers have done an excellent job in collecting and sifting the opinions and wishes of the many buyers with whom they come in contact. This information, too, is made freely available to their clients, but much of it is arbitrary and occasionally it is unreliable, because buyers tend to be interested in particular types of wool—often undesirable and unprofitable types to produce—and their advice is not always of a kind which will benefit the bank account of the farmer.

Again, in preparing the clip for sale, it is frequently necessary to compromise between two or more conflicting requirements. To make the right decision it is necessary for the classer to know something more than a set of arbitrary rules. In addition to the ability to recognise a number of different conditions in the fleece, he must know the "Why" of wool in addition to the "How." To this end, it is clear that the wool classer should be familiar with the principal modes of wool utilisation—Bulletin 167: Wool—Its Use in Manufacture—and the properties required in wool for each, as well as being acquainted with the possibilities and limitation of the different sorts of wool—Bulletin 177: Utilisation of New Zealand Wools.

Subdivision of the Clip on a Processing Basis.

In Great Britain, on the Continent, and in the United States, each of the many firms using wool tends to concentrate on a particular type of manufacture, requiring for its most efficient working, raw material with special characteristics. Buyers do not wish to purchase raw material which is not directly suited to their requirements. To do so, ties up capital for an appreciable time; involves risk of loss from market fluctuations; and in addition, there are costs involved in storing, insuring, sorting and marketing the unwanted material.

Broadly, the most fundamental feature of wool is its fineness, but within most clips, the largest and most important subdivision on a process basis is into Woollen and Worsted types. Wools which are short in staple, or which are so tangled and matted that opening up will involve considerable fibre breakage, are not, in general, suited to the worsted industry. In the combing process, which distinguishes the worsted industry, such short broken fibres would be removed as "noil" and the yield of "Top" would be reduced. Effective length is not the only factor operating, however. Many firms sell their tops as undyed semi-processed material, and since a good colour is always a selling point in a top, buyers for this section of the industry avoid lines containing stained and dirty locks.

Here, then, is the real basis for the emphasis which is always placed on keeping short pieces of wool,

such as second cuts and the fribby discoloured bits which constitute "Locks," separate from the rest of the clip. This material, being short, can only be manufactured on woollen machinery; it can never be made into goods which are to have light and delicate colours because it is often stained by dung, urine or yolk. Similar remarks apply to the necessity for skirting. Discoloured wool from the edges of the fleece, and staples which have become matted with dung, vegetable matter or grease, must be removed as "Skirtings" if the best return is to be obtained from the clip. Short staples, and hairy or medullated fibres from the rear end of the fleece ("Britch") are also undesirable for top making and must be removed. These items never, of course, bring such a good price as the fleece wool and only wool which does not match the major portion of the fleece should be removed. In the same way, wool from the belly, which is frequently stained and sometimes matted, especially at the tips, must be kept separate.

Coming now to the main fleece wool, if this is sound (i.e., is not broken when a staple is pulled) and well grown, it will, in general, be suitable for top making, and the first consideration of the classer must be to remove all fleeces which require special treatment. In this category will come short-stapled, unsound and tender fleeces, where the effective fibre length is too short for combing to be economical; cotts, which require special machinery for the initial breaking up processes; pigmented and stained fleeces which will spoil the colour of the tops; and lastly, fleeces containing seed and other vegetable matter which in any event require special treatment, and if the vegetable matter is heavy will go to firms possessing equipment for carbonising.

Finally, reference must be made to lustre and breed type. The high lustre of Lincoln and Leicester fleeces, the dull appearance of Down wools and the chalkiness of hairy or medullated fibres all stay as permanent characteristics right throughout processing and affect the properties of the final fabric. Great variation in lustre is not common in wellbred clips, but in flocks of mixed origin the range of types found may warrant keeping fleeces throwing towards the Lincoln and Leicester, or towards the Down separate. Similarly, grossly hairy or "tippy" fleeces which are sometimes found in flocks producing crossbred wool, must be kept separate if they do not match the rest of the clip.

Once the fundamental subdivision of the clip into wool for woollen processing (i.e., "clothing" wools)—and wool for topmaking (i.e., "combing" wools)—has been achieved, and provision has been made for isolating fleeces possessing features not typical of the bulk of the clip, attention can be directed to the subdivision of the main lines of fleece wool. If the clip is only a small one, however, say 10 to 20 bales, it is important to realise that classing cannot proceed much beyond what has already been outlined. If too close a subdivision is attempted, the tendency will be to produce small lots which will neither attract nor appeal to large buyers. Where the size of the clip allows further subdivision, the principle followed must depend on what is present, and in certain cases processing requirements may still be sufficiently important within the combing wool group to keep the classing still on a length basis. Thus, early shorn hoggets which were shorn late as lambs, hoggets not shorn as lambs, and wet ewes which were shorn unusually early as dry sheep in the previous season should all go into separate lines. More specifically among stronger crossbred wools "preparing" and "carding" lines may be necessary in the clip. There is no sharp line of demarkation between the two groups, but it is generally regarded as more economical to process wool longer than about seven inches by means of preparing machinery, while wool shorter than this is better treated, prior to combing, on the worsted card. A second subdivision among the combing wools is sometimes important in finer crossbred and Merino clips and depends upon the type of combing machine which is to be used. Wool which is too short for the English or Noble comb—less than 2½ inches—can still be combed on Continental machinery which deals with wool down to about 1¼ inches staple. Such lines are sometimes referred to as "French" or "Baby combing."

Subdivision of the Clip on a Price Basis

It will no doubt have been noted that so far no mention has been made of wool fineness, yield or style. The reason is that these features are important in wool classing more

because they affect the price which the buyer will have to pay rather than the method of processing—at any rate, over the range of fineness normally encountered in a given clip. Subdivision of the clip according to its future processing is the first job of the classer; once this has been done his second job is to make the work of the buyer as easy as possible. To do this, he must avoid packing mixed bales containing wool of widely different values. Fleeces differing in fineness, yield and style may be valued at considerable difference in price and if they are not kept separate the buyer is faced with the difficulty of striking an accurate average value. His price must naturally be conservative to cover him against an inaccurate estimate of the proportions in which the different types occur. If, on the other hand, the price of wool contained in the line is even, he has to make less allowance for error, and the seller gets a higher return.

Within the groups which have already been described, variations in price can arise through differences in "count" (i.e., fineness); through differences in "condition" (i.e., the amount of grease, dirt, etc.) and through differences in "style" (i.e., character). The role of these in classing varies in importance according to the type of clip and to a certain extent on ruling market conditions. In the strong and medium crossbred range—40s to 50s—variations in yield within groups are seldom great enough to affect the classer. "Count" is the predominating feature here, although separate lines are necessary for sandy and dingy or discoloured fleeces. Occasionally in large clips, or in the wool store, a grouping can be made of fleeces within a count and length type having particularly good colour, crimp and freedom from defect. Except for the specialty lines to be described later, however, it is not usual to get a high premium for stylish crossbred wools. Similar remarks apply in the case of ¾ bred wools ranging from 48s to 52s and to a certain extent in halfbred wools ranging from 54s to 60s. In the finer types of halfbred, however, particularly in larger clips and in wool stores, variations in yield begin to come into prominence, the usual practice being to make separate lines for fleeces which are heavy in condition or of poor colour and style. Finally, in heavier conditioned Merino clips, variations in yield can be of the greatest importance to the buyer, even overshadowing considerations of fibre fineness—a factor which is not always appreciated by New Zealand classers. Clearly, variations in yield will be of greater importance in times when there is only a small price difference in favour of fine wools. Even the skilled classer, of course, does not acquire the expert knowledge of wool values possessed by professional wool buyers, but he must be in touch with the market—a fact which stresses the value of classing carried out under the direct supervision of the broker.

The principles stated above for breaking up the main lines of fleece wool on a price basis apply in general to the subdivision of skirtings and other oddments in large clips. First and second pieces, for example, are usually separated jointly on fineness and yield; the finer and cleaner wool becoming "first pieces," while the coarser, more hairy and stained heavy conditioned wool is graded as "second pieces." Necks should be kept separate wherever possible because they are finer and lighter in condition — hence more valuable—than the remaining piece wool. In all cases seedy pieces, necks and bellies should be kept separate from the "free" material unless the quantity of the latter is very small indeed, while heavy conditioned or stained belly wools should not be mixed with more valuable material. It is worth noting that size of line is relatively less important in these oddments which are not bought by the large topmakers.

Overclassing

At this stage, it is probably appropriate to issue a warning against overclassing in fleece wools. Overclassing at the expense of the size of the lines made, can hinder the buyer just as much as inadequate classing. It must be remembered, on the one hand, that whole fleeces containing several different qualities of wool are the units in which a classer must deal, while on the other hand, it is most unlikely that a topmaking firm purchasing a bulk line of say, 48s (medium crossbred) will have no use for sound wool graded a little finer or coarser. An attempt to overclass on a fineness basis would, of course, be particularly undesirable if tender or otherwise defective fleeces were "forced" into the main lines in order to make up their size. In general, it is quite sufficient to divide the main

portion of the fleece wool into "fine," "medium" and "coarse" even with a large clip, while for smaller clips, two groups are sufficient.

Binning and Store Classing

Since the average size of the flock in the Dominion is only about 1000 sheep, it is clear that much of our wool cannot be adequately classed and marketed to the best advantage unless some form of grouping takes place. One possible way of overcoming this loss to the sheep industry is to utilise the "binning" services offered by most brokers for all or at least part of the clip. Under this system, wools to be binned are sent into the store and classed into many lines by an expert classer. The amount of wool going into each category is weighed and subsequently sold under the brand of the broker; the standard charge is 3/8d. per pound. In this way, each fleece is sold to best advantage as part of a large well-classed line, prepared under working conditions of light and labour which usually leave little to be desired. Odd fleeces from large clips classed in the shed should be binned rather than "forced" into unsuitable lines.

A further classing service offered by most brokers is of value to producers of medium and large clips. In this case the wool is skirted and rolled in the normal way, lightly pressed and sent to be classed in the store. It is finally sold under the owner's original brand, but with all the advantages of classing in the broker's store. The standard price is ¼d. per pound.

Speciality Wools

When conditions are favourable a useful return can be obtained by preparing lines for buyers working in trades with exacting requirements. Such buyers often have elastic price limits and profitable prices may be achieved with keen competition. The two main lines of this type are wools for the "paper felt" trade and "warp" Merinos. For paper felts the necessity is for very sound, long stapled wools, well bred, good colour, well classed and within the count range of 36s to 56s. In "warp" Merinos the requirement is for clean, sound, wellgrown wool of good staple length (3-4 inches), crimp, and character. Warp Merino lines are in great demand among local wool manufacturers who continually complain of the lack of this type of wool. A further Merino speciality line which, however, is only of interest to Australian growers is that sometimes made for "superfine" fleeces. Such lines are in demand because of their scarcity and because it is only from such materials that the very softest and finest luxury cloths can be made.

Conclusions

Practical directions for the get-up of the clip are contained in Bulletin No. 26—Preparing the Wool Clip for Market. The present publication outlines the fundamental principles underlying the work of the classer. These are:—

1. Preparation of the clip for market should be based firstly on the most probable mode of utilisation of the lines made.
2. Once wools for the main types of processing have been separated out, further subdivision should be based on factors directly affecting price to assist the buyer in his valuation.
3. In deciding the mode of processing, effective fibre length, colour (stains), and lustre are all important. Length and colour are usually taken charge of during skirting, except in the case of wool from hoggets not shorn as lambs, which should be kept separate from ewe wool of similar fineness. Length may be important in classing clips containing much wool borderline for main processing groups. Seedy wool should always be kept separate.
4. Count, yield and style all affect, primarily, market values. It is essential for the expert classer to follow market conditions in order to secure the optimum balance among these features, and hence the best return for the clip. In general, count is of greater importance in classing strong wool clips, yield and style receive relatively more consideration in fine wool clips.
5. Overclassing at the expense of the size of the lines made should be avoided.
6. The shed classer should use his broker's "binning" service rather than spoil his lines with off-type fleeces.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

FENCE ERECTING

Prepared by the Canterbury Agricultural College, Lincoln.

Bulletin CHRISTCHURCH, NOVEMBER, 1944. No. 184

Tools Required

The following tools will be found useful. For wooden post and batten fences an axe, maul, 1½in. augur, 1in. chisel, saw; for iron standard fences a 4lb. hammer, and for all fences, a crowbar one end with a 3in. chisel shaped face sloping slightly outwards, and the other end pointed, a round shovel, a narrow spade, level, hammer, pliers, wire-cutters, wire twister, wire strainer, rammer and spinning jinny. A convenient rammer can be made by welding a 3in. diameter block of iron on the end of a 5ft. 6in. length of ¾in. piping. A spinning jinny can be bought or can be readily home made by any handy workman. Detailed instructions on these and other points may be found in McKenny's book on Sheep Farming, Fencing, etc.

The photographs on the next page indicate the type of fence being described. Figure 1. shows section of Fence and Figures 2 and 3 spinning jinny and post. The concrete strainers are built footed and with stay slots. The method used at Lincoln College in erecting a concrete post and iron standard 7-wire fence is as follows:—

Specifications: No. 8 gauge wire, 6 plain; No. 12 gauge barbed wire 3in. barb, the top wire; strainer posts 8in. x 8in. x 7ft. 6in. footed when made by a 3in. ledge on two sides of the bottom of the post. Gate posts are made 6in. longer. Stays 4in. x 4in. x 9ft. and foot blocks 1ft. x 2ft. 3in. x 4in. Intermediates 6in. x 5in. x 6ft. spaced approximately 15 yards. Each intermediate is made with holes at correct gauge through which wire staples can be fitted. Standards 5ft. long evenly spaced, 4 standards between posts. The 2 standards nearest to each post being bored with 7 holes and the other two with 8 holes to take a pin to secure a 6in. x 4in. plate which should be fitted where necessary to prevent the standard sinking into the ground when the ground rises between posts. Height of fence 3ft. 5in. from barb or top wire to ground. Gauge 10in., 7in., 5½in., 4in., 4in., 4½in., 6in. (the guage for an 8 wire fence the 1st and 3rd of barb wire might be 10in., 7in., 5½in., 4in., 4in., 4in., 4½in., 5in.).

Estimating Material Required: First drive pegs in where the strainer holes are to be dug (a strain may be up to a maximum of 40 chains but less length is better). Measure the distance between pegs and calculate the number of posts required and distance apart of each post. Drive a peg in for each post hole. For example assuming distance between strainers is 8 chains, 176 yards or 528 feet, material required would be 11 posts, i.e., 12 spaces of 44ft. and 4 standards, i.e., 5 spaces of 8ft. 9½in. for each 44ft. space, i.e., 48 standards of which some would be 8 hole with pins and plates. There are usually 10 standards in a bundle and 5 bundles would be required. Wire—One ½-cwt. coil of No. 8 wire runs approx. 12½ chain, therefore 6 plain wires 8 chains=48 chains, i.e., 4 ½-cwt. coils will be required; one ½-cwt. of barb wire runs 9 to 10 chains, and 77 wire staples will be required for the whole strain and 48 pieces of lacing wire No. 12 gauge 8in. long to lace the barb wire on to the standards.

Laying out Material: Place foot of intermediate posts 18in. away from the peg all on the one side of the line and lying at right angles to the line of fence. Place the coil of barb wire at the one strainer and the spinning jinny and plain wire coil opposite the middle post along with staples, pins and plates. Place 2 bundles of standards at the

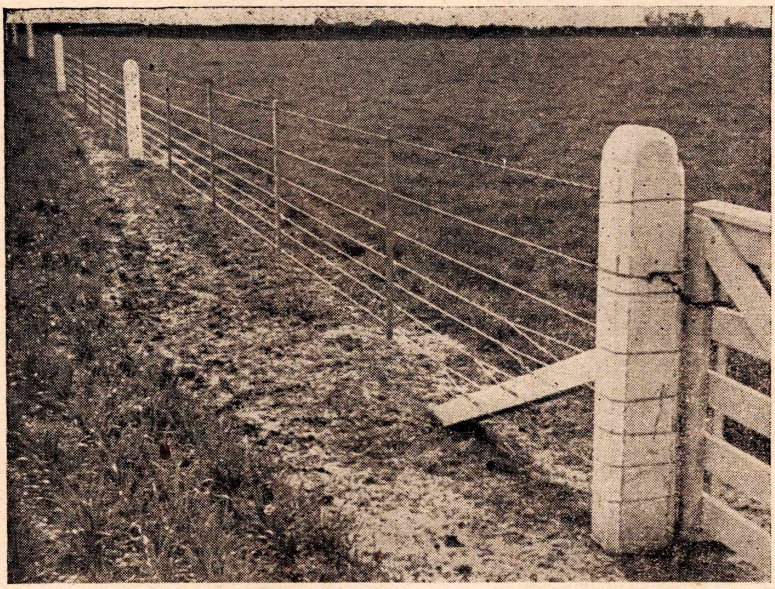


Figure 1.

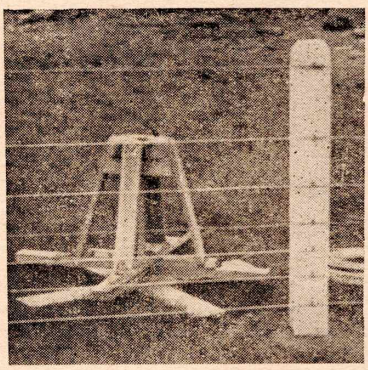


Figure 2.

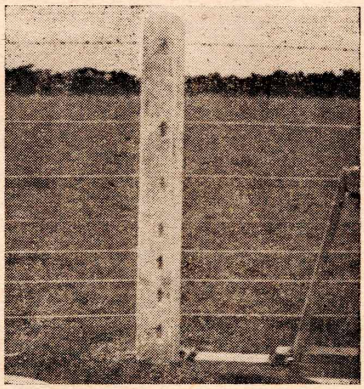


Figure 3.

3rd space from the strainer and 2 other bundles at the 8th space from the strainer. Cut timber, the length of the stay, 9ft. x 3in. x 1in. and 2 T sticks 3ft. 8½in. long the height of the post out of the ground.

Erecting: First mark position of wires and ground level on the strainer post. Dig the hole required 4ft. deep, 1ft. 4in. wide, 1ft. 10in. long and when down 2ft. dig a step 15in. deep. Before tipping up post place the crowbar in the hole against the far side so that the foot of the post will slide down against it. Before ramming see that the post is square to the line of fence and ram with a slight lean away from the strain. Use the 9ft. x 3in. x 1in. stick to mark out stay trench and hole for foot block. Dig foot block hole 2ft. deep. An assistant is required to hold the stay up in position while the block is rammed up tight. Do not ram side of stay until later, when it is clear that the stay has been placed exactly along the line of the strain. Put in strainer and stay at the other end.

Run a wire to each strainer and tie round strainer where barb is to go. Strain it up tight. In an 8 chain strain on level ground the wire on a calm day will give a straight line. Use the wire to mark out the front of holes 3in. from the wire. (With heavy concrete posts it is easier to ram the front than to

place exactly in the right position against the side of the hole). Prop wire up on standard out of the way and dig holes. To get a level top line fix standards or timber across face of each strainer so that top edge is 1in. below top of post. Tie T. sticks to standards half-way between middle post hole and strainers, the tops to be level with standards or board on the face of strainers. Use a 6ft. T stick to estimate when the post hole is deep enough. (When working with concrete posts is is better to have the hole 1in. too deep than too shallow).

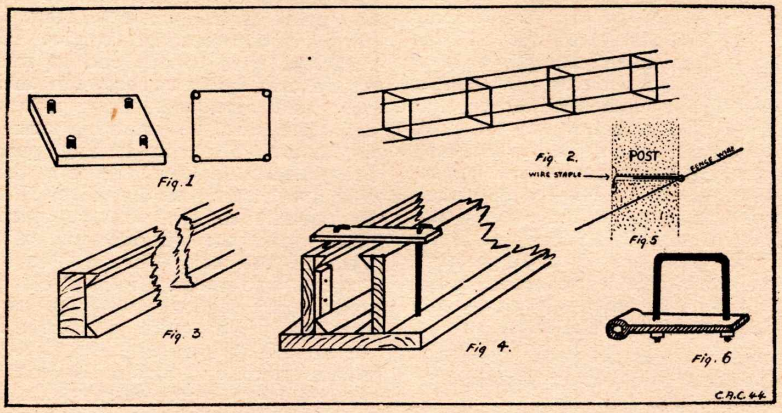
Let the guide wire find its correct position and put in middle post first, then the one next to it. In case of a high wind the alignment of these posts must be checked by sighting to see that they are in line with the centre of both srainers. After all posts are rammed, staple guide wire to top hole of posts packing it $\frac{5}{8}$in. from face of post with a bit of stick or the tapered peg used for marking the hole. By packing guide wire $\frac{5}{8}$in. from face of post the holes of the standards will be in line with the face of the posts.

Lay out of Standards: It will be found convenient to stick them in the ground 3ft. back from the guide wire about 3 yards apart. Place foot plates where required under wire in the approx. correct position. Then drive standards using the 9ft. x 3in. x 1in. stick marked at 8ft. 9$\frac{1}{2}$in. to obtain the right spacing, placing one end of the stick at centre of post. Use a level to ensure driving standards in perpendicular, one edge of standard just touching guide wire. To allow for sag in guide wire hammer standards in till the top is $\frac{3}{4}$in. above the guide wire. In the case of the 8 hole standards put the point of the standard into the foot-plate slot before driving.

Running the Wires: Cut the guide wire in the middle and at the strainers 8in. from the strainer, the 8in. length being used later to make a figure 8 knot with the barb. Thread one length of guide wire through the bottom holes and fasten it to a loop of wire round the strainer and stay, at the opposite end, in such a way that the strained wires are in line with the centre of the stay. Walk back to the middle and thread the other piece of wire and tie to a loop made round the opposite stay and strainer. (If the wire is tied to the edge of the strainer so that they lie alongside the stay, the strainer is liable to twist in soft ground and so break the point of the concrete stay, thus allowing the strainer to give). Join sufficient wire to one end at middle and strain halfway between middle post and standard. Then unlace a coil. See that the running end has not a half-hitch in it and put on the jinny. Usually there is a "start this end" label on the wire. If not, be careful to see that a start is made with the outside end of the wire in the coil. Thread this wire through the second holes from bottom and fasten to loop round strainer. Cut wire at jinny and thread the other way. Cut at the proper place and strain. Repeat this process four more times. In the case of undulating ground staple wires on rises and depressions before straining except in the case of the barb. Run out the barb wire last. Tie to the short piece of plain wire on each strainer and strain in the middle. Then staple wires and hammer standards down until the majority of wires vibrate freely in the holes, thus levelling up standards. When stapling the barb wire remove the barbs if they are very close to the hole in the post. Finally lace barb to standards.

General: Trim off ends of figure of 8 knots with cutters, also at straining joins and strainer posts. Bag up all short bits of wire and labels. Don't use a short stay. Under 8ft. is useless. A stay 9ft. is better, provided it is bulky enough, a long thin stay will bend. At Lincoln College the stays are slotted into the posts at a height of 1$\frac{1}{2}$in. above the middle line of the fence, i.e., the top of the strainer post is 45in. from the ground and the middle of the stay slot is 23in. from the ground. The slot comes between the 3rd and 4th wire, counting the barb as one. If the stay is put too high and is too short in length it is liable to lift the post out of the ground. In the description given the posts are 6ft. long. For cattle fences on soft ground it would be better if the posts were 6ft. 6in., the posts being placed a further 6in. in the ground and closer together, say about 7 yards instead of 15 yards apart as in the above example. Posts which taper towards the top make for lighter handling. All strainers, and dip posts must be well footed. Posts should be placed in the hollows and on the rises.

When using willows etc., for posts that are later expected to grow as trees, staple wire on to a batten attached to the tree by nails.



MAKING CONCRETE POSTS

Mixture:

Shingle, ¾in. washed, 8 kerosene buckets; sand, washed, 4 buckets; cement, 2½ buckets. Mix thoroughly. Water, 1½ kerosene buckets, more or less, according to wetness of shingle and sand. Add water gradually and stop while mixture will still hold itself together and not flop out on the floor. Reinforcing, 4 5/16in. rods, 1 inch from sides held together by wire stirrups. (Reinforcing—1/16in. of iron for each square inch cement).

Result

The above mixture will make 6 posts 5in. x 6in. x 6ft. long, 1 strainer 8in. x 8in. x 7ft. 6in. long, 2 strainer stays 4in. x 4in. x 9ft., 3 foot blocks 1ft. x 2ft. x 3in. x 4in.

Moulds are filled in morning and removed the following morning. Posts lie in situ for another 24 hours. They are then stacked for a week and then painted with King's White Cement while still green and allowed to dry slowly for one month or longer. Concrete becomes brittle if dried too quickly. Posts should be made during the winter.

The drawing inserted shows the method of construction involved. Figure 1 depicts the framework used in making and the wire to support the four steel rods (see Figure 2). Figure 3 shows the method of bevelling the corners of the mould depicted in Figure 4. Figure 5 shows the wire bent to form staples for inserting in the mould at the appropriate positions. Figure 6 shows the type of clamps used to hitch the gate hinge to the concrete gate post.

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CANTERBURY CHAMBER OF COMMERCE

AGRICULTURAL BULLETIN

THRESHING SMALL SEEDS

How to avoid losses in header harvesting

Prepared by the Canterbury Agricultural College, Lincoln.

Bulletin CHRISTCHURCH, DECEMBER, 1944. No. 185.

Introduction

In this bulletin methods of avoiding losses due to skinning and cracking of seeds in threshing will be considered. An appreciation of the very great value of the seed business to New Zealand generally can be obtained from the following figures showing the increase in quantities and values of grass and clover seed exported over recent years.

Exports of Grass and Clover Seed

Seasons	Cwt. (1000)	Value (£1000)
1939-40	40	£324
1940-41	58	£402
1941-42	99	£661
1942-43	62	£427
1943-44	106	£915

This table shows an increase from under one third of a million pounds to almost one million pounds. Farmers are nowadays making a business of seed growing and not as in the past years merely saving occasionally surplus grass and clover for seed as a catch crop.

The export of seeds from New Zealand has been given a great impetus over the war years — due chiefly to the fact that our best customers — United Kingdom and Australia — have not been able to secure supplies from other European countries, and have had to rely upon New Zealand for their supplies of ryegrass, cocksfoot, white clover, etc. Normally these varieties can be obtained from Denmark, France, Poland and other European countries, and we in New Zealand have had to compete on a price basis with these countries. The time is not far distant when these countries will again be competing with us for the United Kingdom market, and it behoves New Zealand farmers and merchants to see that no opportunity is lost to hold what we have gained over the past few years. We can produce the finest seed in the world—both in strain and quality.

The advent of header harvester machinery has brought about many problems and farmers have much to learn about the use of them. Damage caused by inexperienced handling of these machines is particularly serious in the case of red clover and ryegrass seed. Inefficient adjustment results in a big loss due to cracked and broken seeds. This damage is reflected in the decreased value of the seed, and in many cases it prohibits export.

Farmers should realise that cracked and broken seeds cannot be dressed-out on seed dressing plants and in the years to come lines containing damaged seed are likely to be difficult to sell. More and more the tendency is for merchants to buy seed on a machine dressed basis and subject to a purity and germination test. Lines of seed which do not measure up to the normal export standard — in most cases 98 per cent and 90 per cent germination — will be unsaleable in years of low export demand. It is hoped that there will continue to be a big demand for New Zealand seeds overseas, but to ensure this the seed must be of the highest strain and grade. This is primarily a matter for the grower—to see that he has the best strain available and gets it into the bag in the best possible condition.

An example of the losses that occur is shown by the facts set out in a report issued by the Seed Testing Station, Department of Agriculture, Palmerston North. For the 1943-44 harvest 20 per cent of the total samples of Montgomery red clover failed to conform to the 98 per cent purity standard, by

reason of broken seed content; and 30 per cent of the total samples failed to comply with the minimum trade germination standard of 90 per cent, by reason of the abnormal seedlings produced from the broken and cracked grains. Further, in many seeds internal fractures are produced which are not visible but which result in the seedlings being bruised. Some of these seeds may germinate while fresh but they have not the vitality to produce a plant under field conditions. These figures show startling results from bad handling in the case of Montgomery red clover, but similar injury may occur in the case of barley, wheat, peas and ryegrass, etc. Damage may result to peas if they are bruised through threshing when too soft. The farmer often cuts the crop on the green side to obtain a good colour. Bleached peas are always at a discount on the market, especially blue peas which are used for human consumption. These crops must be cut green but allowed to dry thoroughly before threshing. Damage to white clover seed does not normally occur but great damage to ryegrass may occur where attempts are made to thresh out white clover and ryegrass in the one operation.

Reduction of Losses

Damage may be reduced or avoided by paying stricter attention to the condition of the material when threshing, and to the adjustment of the threshing machine.

Condition of Material When Threshing

The crop should be allowed to dry out before threshing is begun. This object will be more easily achieved if the crop is cut after it has reached as near maturity as possible and if sufficient time is allowed between cutting and threshing. In the case of direct heading, the crop should be allowed to get dead ripe before threshing. When the material is threshed out of condition the seed is soft and easily bruised, resulting in damaged seed. Further, it is essential that threshing should not be commenced too early in the morning and should cease the moment the material toughens up towards evening. When the crop is windrowed an attempt must be made to lay a windrow that permits of even drying and is therefore not too thick in any one position but yet not laid so thinly as to involve risk of loss of seed. The laying of suitable windrows can be assisted by the use of an inside and outside divider board on the mower, or by attaching a spreader bar to the table of the binder. Seed loss can be reduced to a minimum if the heads are laid up on top of the previous straw butts in a scale-like manner. The angle at which the windrow is laid should depend on the type of pick-up attachment and the direction of feed to the drum. The minimum cracking will be involved where the material has been laid in a thick bulk where the heads are fed direct into the drum. To avoid bruising it is necessary to have an evenly distributed flow into the drum. It may be necessary under certain conditions to use a windrow spreader on the header. A uniformly dry swath is the ideal but is possible only with a mechanical method of lifting from undergrowth or damp ground. Drying may be assisted by mowing under the windrow or by raising up the windrow from the undergrowth by using a special swath pick-up and aerator prior to picking up again for threshing.

Experimental trials last season showed that it is now possible to lift a swath mechanically from a new growth or from damp ground conditions. Within a few hours under suitable conditions of sunshine and wind, threshing can begin always provided the crop itself is fit.

Adjustment of the Threshing Machine

To avoid cracking and bruising, five main adjustments to the header require continuous attention:

(1) The number of concave bars should be reduced where removable to the minimum necessary to thresh. In the case of the peg drum machine the number of pegs should also be reduced to the minimum possible while still separating out the seed.

(2) The clearance between the drum and concave should be as wide as possible while still ensuring the threshing out of the seed.

(3) The drum speed should be reduced to the minimum speed that will still give clean threshing. Under changing atmospheric conditions it will be found necessary to vary the settings and drum speed throughout the day. If adequate adjustment is not possible it is better to cease threshing until conditions are satisfactory.

(4) A further cause of damage may be due to excessive return of seed to the drum, so that much of the seed may be threshed two or more times. The liability to loss here can be reduced by threshing only when the material is in good order, by proper adjustment of the drum, spacings and speed and also by proper adjustment of the blast and riddles. The blast should be so regulated as to blow out all light cavings.

(5) The riddles should be opened as widely as possible, or as large a size of riddle as possible used, or even the riddle removed so as to avoid all unnecessary return of seed to the drum. Subsequent dressing may be necessary and it is preferable to leave some of the unnecessary material rather than risk damage to the seed by close setting or use of small riddles.

Summary of Recommendations

To obtain purity and germination, sufficient to gain the highest certificates, the following precautions should be taken:—

(1) General: "The minimum that can be done to extract the maximum of good seed, gives the best final result" . . . because (a) If seed is threshed too hard broken growths or bruised seed is the result. (b) Once the wings or tails of weed seeds such as hair and goose grass are broken it is almost impossible for cleaning plants to obtain purity and germination standards. Weed seeds as well as main crop seeds must be left, then they can be dealt with by up-to-date seed cleaning machinery. Do not try to make a machine dressed sample on the header. Nature has so fashioned her seeds that there is a reasonable chance of separating them if they are left in their natural state.

(2) Ryegrass. Damaged seeds are largely the result of—

(a) Too high drum speed.
(b) Concave too close.
(c) Too great a return to the drum through the tailing elevator—caused by too small a finishing riddle or adjustable riddle closed too much.

(3) Mixed ryegrass and white clover: If good certified ryegrass is wanted do not try to shell the white clover while harvesting. A modern N.Z. built dressing plant will extract the grass seed from the unshelled clover and unbroken weeds. This gives the maximum quality ryegrass. The unshelled clover and weed seeds can then be satisfactorily treated and all the clover can be extracted also.

(4) Italian ryegrass: All the above factors apply, but of most importance is the necessity to preserve the tail by the utmost care in the above adjustments.

(5) Cocksfoot: This seed may be threshed harder than ryegrass. Care is required not to shell the seed or to break the straw.

(6) Clovers: These crops should not be threshed from windrows until they are thoroughly dry and have had the maximum benefit from sun and wind. On no account should they be threshed on a dull or damp day. Under these conditions some of the top of the windrow may be dry and hard, but the bottom will contain soft and easily damaged seed. If the windrow is lifted this will assist uniform drying. If some seed is left in the cob this can be satisfactorily treated by modern seed dressing machinery. Damage and loss is largely caused through trying to thresh clover from the cob when the crop has been too recently cut and not sufficiently weathered.

Necessity for Skilled Operators

At some future date it may be practicable for those operating headers to attend short courses in header operation and adjustment at Lincoln College and obtain a certificate of proficiency in this important work. At present some contractors have a tendency to put the job through without regard to the quality of the seed threshed. It is difficult for farmers to check this even after they have realised the damage likely to result as under existing conditions the contractor may leave the job and go to the next. It would assist to improve matters if it were possible to organise payment of contractors on the results achieved. Montgomery red clover, of which by far the greatest proportion is header harvested, is a late maturing crop and not usually ready for harvesting before late March or April. At that time of the year even on clear days, morning mists and evening dews narrow down satisfactory header operation to four or five midday hours. The farmer with one eye on the weather and the contractor harvester with his mind on crops still to head are both tempted to exceed the optimum hours. When the seed fails to shell—nature's indication to stop trying—the tendency is to screw up the machine

another notch and carry on. This is when the damage is done. The seed itself is dry and brittle but the cob has become tough and even though the damage is not apparent the seed has cracked beneath the skin although seemingly still whole. It is not until the germination reports come back from the seed testing station that the sad story is told. Such seed is difficult to sell on the overseas market and may have to be sold in the local market at a big discount.

Conclusion

The damage caused by faulty threshing can be very great and cannot be remedied by machine dressing, as most of the chipped seeds and all of the cracked and bruised seeds remain in the dressed line.

Under methods of testing prescribed by the International Seed Testing Association cracked and broken seed is classed as inert matter—an impurity. The presence of over 2 per cent of impurities means that the purity of the whole line falls below 98 per cent—the minimum percentage of purity required for first class standard export seed.

Twenty per cent of the total red clover 1943-44 lines fell below this standard by reason of broken seed content alone.

Broken growths are abnormal seedlings produced by apparently normal seeds the embryos of which have been partially or completely fractured. This injury renders the seedling incapable of establishment in soil. The percentage of germination required for first class standard export seed is a minimum of 90 per cent.

Thirty per cent of the total 1943-44 lines fell below this standard by reason of broken growths from damaged seed.

Losses can be reduced by strict and continuing attention to the foregoing suggestions regarding care in harvesting.

Other Bulletins that may provide useful information on this subject are No. 137, Harvesting of Small Seeds, No. 161, Quality in Pasture Seeds, No. 149, Operation of the Header Harvester, and No. 150, Adjustment of Header Harvester for Various Crops.

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ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

USE OF MOWER

Prepared by the Canterbury Agricultural College, Lincoln

Bulletin CHRISTCHURCH, JANUARY, 1945. No. 186.

Introduction

In Bulletins 150 and 185 it was pointed out that one secret of success in pick-up header operation depended upon the laying of a suitable windrow. Where the windrow is laid with a mower a good knowledge of methods of operating and adjusting the mower for the varying conditions met with is essential. With proper adjustment an old mower can be made to work under difficult conditions whereas a new mower improperly adjusted will not only cause excessive draft and breakages but under adverse conditions may even fail to cut the crop. In this bulletin routine adjustments to the mower will first be dealt with and then special adaptations for particular crops will be discussed.

The routine adjustments to the mower will be dealt with under the headings of (1) Setting of the mower knife blade, (2) adjustment of knife clips and wear plates, (3) replacement and alignment of ledger plates and sharpening of knife sections, and (4) general.

Setting of Mower Knife Blade

The knife end of the pitman rod should be at right angles with the mower frame when working and in most makes has a lead of ¼in. when at rest. More lead can be given by shortening the drag bar or lengthening the brace bar, or both, dependent on the register of the knife. Correct register of the knife implies that the knife sections should reach just beyond the exact centre of the ledger plates at the end of each stroke. If at the end of the stroke the knives reach beyond the ledger plates the drag and brace bars must be lengthened. If the knives do not reach the centre of the ledger plates difficulty in cutting will be experienced. To remedy this the drag and brace bars must be shortened. In some cases it may be necessary to adjust the length of the wooden pitman arm. The lead of the pitman rod and the register of the knife should be adjusted at the same time. In most mowers the pitman rod revolves as the pole is raised. Before attempting to centre the knife on the ledger plate it is very important that the mower hitch or pole be set at the correct working height; if a horse drawn mower the pole should have a support about 32 inches high placed under the neck-yoke end and if a tractor pole is used, hitch at the height as used on tractor. The correct centring of the mower knife is very important as it facilitates starting of the knife blade in and out on each stroke.

The angle of the cutter bar also requires adjusting to give a lead at the outside end when the machine is at rest but in working position of 1in. for a 4ft. bar, 1in. to 1¼in. for a 5ft. bar, and 1¼in. to 1½in. for a 6ft. bar, or according to the maker's instructions. The method for checking the correctness of the lead is to stretch a cord to the outside edge of the cutter bar along the edge of the two wheels or the eccentric or in some cases the pitman bar, dependent on the make of the mower. Adjustment can usually be made by turning the eccentric bushing on the hinge pin above the inner shoe, or otherwise slightly altering the angle of the inner shoe, until the proper amount of lead is obtained at the outer end of the cutter bar. Wear in the hinge pins of the inner shoe allows the outer end of the cutter bar to hang back so that it is no longer in line with the pit-

man bar. This lag causes excessive draft and broken pitmans. On many machines the only means of correcting this is to put in new pins. If the shoe holes are badly worn it may be necessary to reshape them by welding since the holes wear egg shaped and new pins may not take up all of the slack.

2. Adjustment of Knife Clips, and Wear Plates:

The wear plates should be adjusted forward or replaced with new ones so that they are in a straight line and hold the knife sections forward and upward at the rear so as to contact the full length of the ledger plates starting at the inner shoe first. The knife clips, sometimes called "knife guard" should be kept down by hammering on the top of the arch until there is a clearance of 1/32in.-1/16in. (about the thickness of a postcard) between clips and the knife when it is replaced. If the knife clip is down too far prise it back by using a punch on the under side of the knife clip. It is important that the knife should rest square, level and hard down on the ledger plates. If necessary use a piece of piping as a hammer to raise or lower any particular finger that is out of line.

3. Replacement and Alignment of Ledger Plates and Sharpening of Knife Sections:

If the ledger plates are worn smooth and rounded on the edge they should be removed. Hold the finger firmly on a suitable anvil which can be purchased. If anvil is not available a heavy hinge or block of iron with a hole in it may be used. Drive out the rivet by punching on the flat end of the rivet using a pin punch. Instal the new ledger plate and rivet in position and tighten the rivet with a hammer. Replace the finger, tighten the bolt and align the fingers so that the ledger plates are in line and the knife sits squarely on them. Get the fingers parallel, the one at the pitman end should be set first and the others then set parallel to it working outwards. Hammer the fingers up or down to the extent necessary using the hammer on the thick part of the finger to avoid breakages. Hammer the wings of the fingers so that they meet the edge of adjoining wings. After tightening down the cutter bar test to make sure all ledger plates are in line. Remove old and worn or broken knife sections by shearing off the rivets by placing the knife on edge points downwards on the side of an anvil and delivering a sharp blow on the back of the knife section. Replace with a new knife section by inserting new rivets through the knife bar and section. Rest the knife bar on a flat anvil and rivet on the knife side making sure that the head of the rivet only is resting on the anvil or other support. In rivetting swell the end of the rivet by a few blows with the hammer and then round the end by blows around the edge. Sharpen all section knives except the new ones maintaining the same bevel and angle on the old section as on the new ones.

4. General:

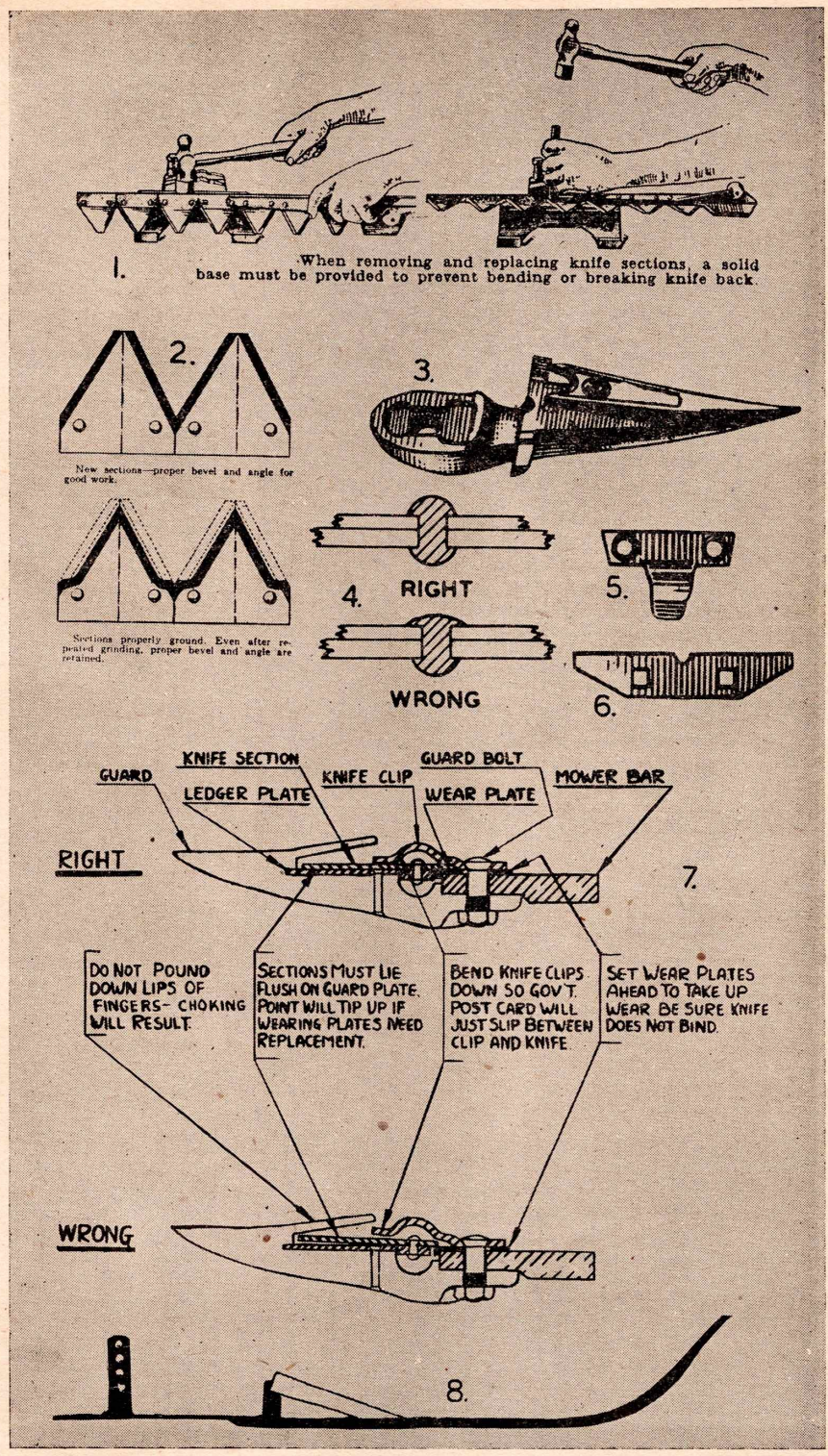
The lift spring should be tight enough to prevent the shoes from falling too heavily to the ground and to enable easy lifting and slack enough to facilitate immediate fall of the cutter bar to the ground after passing over obstructions or after being lifted. It is necessary to examine all parts of the mower, tighten up nuts and tighten or replace worn bearings which permit undue play, and in particular any bolts or bearings which permit the working parts of the mower to get out of correct alignment. The lock nut on the outer end of the pitman bar should be maintained loose enough to allow free working. The most usual causes of inefficient mower working are incorrect angle of mower knife bar, knife sections not resting in the centre of the ledger plate at the inner and outer end of each stroke, worn wear plates, knife clips too high, blunt knife sections, worn ledger plates or imperfect alignment of ledger plates.

Special Adaptations for Particular Crops

This section will be discussed under the heads of (1) Cutting at various heights, (2) Gathering of the crop behind the mower, and (3) Alternatives to mowing.

1. Cutting at Various Heights:

For topping white clover crops and removing harmful grass and weed heads extra iron bars (e.g. 4in. lengths of an iron standard), suitably bored can be bolted on to



1. Removing and replacing knife sections. 2. Correctly ground sections. 3. View of finger. 4. Right and wrong methods of rivetting. 5. Knife clip. 6. Wearing plate. 7. Right and wrong setting of knife. 8. Goose-neck for fitting on outer shoe.

the inside and outside settings for the mower shoes. To cut very low, as for example for short white clover the mower shoes may be removed, very short fingers may be fitted, and the angle of the cutter bar tilted even beyond the usual adjustment of the machine by lengthening the tilt bar. The fitting of an extra seat over the inner wheel and provision of a foot rest above the inner shoe enables a man's weight to press down on the inner shoe. By using a specially made light wooden hand rake any blockages can be quickly removed. For some light crops, for example a light crop of white clover, the fitting of a special lespedeza bar with more numerous and narrower guards may be helpful.

For the cutting of garden peas on well cultivated soil the mower may be made to work at approximately 1in. underground by a sufficient tilting of the cutter bar. A special worn cutter bar can be kept for this purpose so as to avoid wearing down the cutter bar used for ordinary crops. Alternatively in the case of garden peas or similar crops to avoid cutting the stalks lying on the ground special pea-lifters may be fitted on to the end of every third or fourth finger.

Where the crop lies in one main direction away from the prevailing wind it may be necessary to cut the crop one way only.

A goose-neck, a piece of steel about 2ft. 6in. long looped upwards and fitted on to the end of the outside guard so as to press down on the crop ahead of the outside edge of the cutter bar, enables a clean straight cut to be made and greatly facilitates cutting tangled or lodged ryegrass and similar crops.

An increase of the speed at which the knife cuts in relation to the drawbar speed also assists cutting of tangled crops. It is only in certain types of mowers that this adjustment can be made.

2. Gathering of the Crop Behind the Mower:

Where the windrowed material is later to be picked up and threshed by a header it is preferable that the width of the cutter bar used for normal heavy crops be the same width as the cut taken when direct heading, and that the windrow be laid with the seed heads up but gathered in by divider boards so as to facilitate picking up. The width of the swath should be about 1ft. less than the width of the pick-up to be used. In the case of wide mowers, if two knife bars are available a shortened bar can be used for this work. To avoid running over the crop on the next cut an outside divider board is used. For high crops a grass stick is attached to the divider board. To assist gathering short crops a thin sheet of steel about 3in. wide and tapering off at the cutter bar end is often screwed on to the under ledge of the divider board. For bulky material the fitting of a longer board on to the divider board, almost doubling its total length, may be more effective than setting the divider board at a sharper angle. Exact knowledge of the width and type of pick-up to follow should be available before mowing. For example a long stubble is suitable for the steel rotary type of pick-up but unsuitable for the draper type which operates best on a short stubble. There must be active co-operation between the man who lays the swath and the man or contractor who later is to pick-up and thresh the crop. For peas, pea rollers are often bolted on to the rear of the cutter bar. To make a narrow row and avoid running over the cut material an inside divider board with or without grass stick attached can be used in conjunction with the normal length or much longer outside divider board. For gathering light crops of, for example, white clover, a specially shaped sheet of galvanised iron may be hinged to the cutter bar with a gap cut out of the centre part of the sheet into which the whole width of the cut eventually falls, assisted by means of periodical rakings of the material collected on the inner and outer portions of the shedder boards to which the galvanised iron is attached. An extra man with a rake working on a pivot and sitting on the extra seat as previously described is invaluable. A side rake may be used behind the mower to rake the cut material into a narrow row for the pick-up while still green and to leave a clear track for the next mower cut.

3. Alternatives to Mowing:

A side delivery mower may be used. When red clover seed crops are later gathered with a sweep or forked on to low trolleys for threshing, the side delivery mower is to

be preferred. By adjustment of the frequency of the sweep, thin crops can be gathered into suitable bunches or heavy crops deposited in a continuous row with each turn of the reel.

The most usual method of windrowing crops such as barley or wheat is by the use of the binder. By this method a full width cut or alternatively narrower cut may be taken and deposited over the edge of the platform canvas or dropped from the table in a continuous row. In the case of very light crops where two binders are used, both binder cuts may be deposited in the one windrow by putting the cut material over the platform canvas of one binder and over the table of the second machine. Alternatively a special windrower machine may be used. For light crops liable to shake, the cut-off heads may be collected on a sledge dragged alongside the windrower, bagged up into lightly filled bags of seed heads, these bags stooked in the stubble for drying and when dry carted without loss into a sheltered, sunny position for threshing.

To assist pick-up by the ordinary spring tine pick-ups of headers the following adjustment is usual when windrowing barley or wheat with a binder. Collapse the sheaf carrier and tie back or remove it. Affix a batten to the underside of the table and extending outwards about one foot at the front end of the table of the binder. Take a strip of hoop iron curved under at one end and affix the uncurved end to the sheet metal casing above the table in such a way that the curved end checks the heads of the straws while the butts slide downward over the extended batten. By this means the windrow is laid at an angle and picking up with the ordinary spring tine type of pick-ups is facilitated.

For dry stalky crops the use of the serrated knife working on plain ledger plates is the usual arrangement on binders. But for heavy linen flax crops it will be found better to use on the binder the plain knife well sharpened working on the serrated ledger plates, the usual arrangement on mowers.

The accompanying plates, some of which are taken from mower manuals and others from a book entitled "Farm Machinery and Maintenance," printed by the New York State Education Department, and others from materials used at Lincoln College, greatly facilitate understanding of the method of making the adjustments discussed.

Conclusion

A mower properly adjusted can be made to cut difficult crops easily and quickly. Improperly adjusted the job, even if breakages are avoided, will require wasteful expenditure of time and labour.

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ELLESMERE GUARDIAN PRINT

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

PRINCIPLES OF UTILITY POULTRY FEEDING

Prepared by the Canterbury Agricultural College, Lincoln

Bulletin CHRISTCHURCH, FEBRUARY, 1945. No. 187.

In view of the present shortage of poultry feeds, it is hoped that the information given below will be of some assistance to poultry keepers and farmers in their endeavour to make the best use of the various alternative feeds available. This bulletin deals with the principles of feeding for maximum egg production: a further bulletin, to be issued shortly, will detail various rations and methods of feeding. Since poultry are more often than not a side line, it is not always possible to do everything that is needed to achieve maximum production; but the following discussion of the principles underlying high egg production should enable the small poultry keeper to do the best possible in his own particular circumstances.

Nutritional Value of Eggs

Since it requires at least 4 ounces of feed to produce one 2-ounce egg, of which 65 per cent is water and 12 per cent shell, one is led to ask: "Is this the best use that could be made of that feed; and if so, what is the special virtue of eggs as human food that warrants this seemingly costly conversion?" The answer is that eggs share with milk the first place in the small group of "protective" or health and growth promoting human foods*, (as distinguished from the staple energy giving foods) and that they hold this position by virtue of the large assortment of minerals and vitamins they contain, these being essential for bodily well-being and especially for the healthy growth of young people. The provision of a sufficient quantity of such protective foods at a price within the reach of everybody is therefore a matter of national importance.

*i.e.: milk, eggs, liver, cheese, meat and green leafy vegetables.

Feeding for Production

The carefully bred productive ability of today's utility strains of poultry cannot be fully exploited by the haphazard backyard methods of using the fowls to clean up the scraps, throwing them a handful of grain apiece, and leaving the rest to nature. The production of a 2-ounce egg day after day is a truly remarkable performance for the small body of a hen, and the efficient poultry feeder knows that in order to maintain this production for a considerable period the hen must be receiving each day, in addition to her own maintenance needs, sufficient additional nutrients of the right kind and in the right proportions to make that egg. Mere maintenance of live stock, without production in the form of growth, reproduction or saleable produce, is sheer waste. It is like paying rent for a farm and then leaving it idle.

What then are the nutrients required for maintenance, growth and egg production?

A Balanced Ration

All foodstuffs are made up of five distinct kinds of nutrient, each capable of being digested and used by the body for some special purpose. These are Carbohydrates (sugar and starch), Fats, Proteins, Minerals and Vitamins; plus, of course, water. Carbohydrates and fats are used mainly for warmth and energy. The proteins and the minerals, such as lime and phosphorus, are the essential body building materials, the proteins forming the flesh, and minerals the bone of the body. Lastly, the various vitamins are needed to enable the complicated chemistry of the body to run smoothly. Insufficient of any one of these essential nutrients will impair healthy growth and production, and may cause disease and death.

For example, lack of Vitamin A (plentiful in green feed and yellow maize) causes "nutritional roup" and general unthriftiness; lack of lime and Vitamin D (the latter provided by sunlight or cod-liver oil) causes rickets and thin shelled eggs; while lack of Riboflavin, one of the Vitamin B complex (plentiful in green feed and milk) results in a serious stunting of growth. A complete and balanced diet must therefore provide all these essentials in the right proportions, otherwise much good food will be wasted. Fortunately, most of these essentials are plentiful in the common foodstuffs, but there is the possibility of an otherwise sound ration being short of one or more of the essentials, as in the examples cited above. **It is a simple matter, however, to ensure that the ration is complete if the usual grain and mash diet is regularly supplemented with fresh green-feed, lime, salt and when available skim milk and cod-liver oil.** Protein, which is essential for the formation of meat and eggs, is present to some extent in all foodstuffs, but is much more plentiful and of better quality in the protein-concentrates of animal origin, such as meat, meat or blood-meal, fish-meal and the curds of milk. One or more of these should always be included in the mash.

Maximum Feeding

The fowl's digestive system is not large, it will only cope with 4-4½oz. of feed per day, and if ample nutrients for prolific egg production as well as for her maintenance are to be encompassed within this small space, two cardinal principles must be observed: (1) the ration must contain the minimum percentage of indigestible and unwanted material that is consistent with the health of the bird and the palatability of the feed; (2) the laying bird must be induced to eat the maximum quantity with which its digestive system can cope. Maximum consumption of digestible food and high production go hand in hand.

Three properties of the mash are important in this connexion: its bulk, its palatability, and digestibility. If the mash contains a high percentage of fibrous material such as bran, lucerne chaff, chopped green feed or vegetables, the quantity the bird can eat will not contain sufficient nutrients and the mash will be too bulky. Conversely, the higher the percentage of ground meals the less bulky and richer is the mash.

But here the questions of palatability and digestibility come in. Birds have little sense of taste or smell, and select their food largely by its appearance and feel when swallowed. Thus bright shiny grains of maize are always picked up first, while feed given in a dwindling light may be left untouched by hungry birds. Now, a mash containing too much fine dusty meal, if fed as "dry mash" is unpalatable to them as it sticks to the beak and throat, clogs the nasal passages and may swell uncomfortably in the crop, all features that discourage the bird from eating its full ration; while if it is fed "wet" it tends to form a stiff doughy mass that is not quickly and completely digested and is inclined to cause scouring. Such a mash should be "opened up" by the addition of bran till a moistened lump when dropped on the floor breaks readily to pieces. **For high production purposes the bulkiness of the mash must therefore be reduced as much as it can be without becoming unpalatable and indigestible.** It follows that the bulky vegetable feeds, greenfeed, potatoes and roots, while being valuable supplements to the more expensive grains and meals, can only be included to a limited extent in the ration of laying birds if anything like maximum egg production is to be obtained. If these have to be used liberally owing to the shortage of the other feeds, then a lower egg yield must be expected. It will also be clear from the above that it will usually be false economy to purchase cheap low grade feedstuffs, when better can be obtained.

Systems of Feeding

There are several possible systems of feeding, the soundest and most popular being the "grain and mash" system. Birds will consume practically the same dry weight of food whether it be as whole grain or mash, and whole grain is cheaper per food unit than mash; but the objection to feeding grain only is that grain by itself is not a balanced ration. Pollard and bran, on the other hand, are richer in certain essential minerals and vitamins than is the whole grain, and the mixing of the mash is the easiest way of adjusting the ration and

supplying those nutrients needed in greater abundance. Though grain and mash are usually fed in equal amounts, one at morning and the other at night, it matters little which is fed first, and no harm will follow a change in their proportion (made gradually) should one or the other be difficult to procure.

Opinions differ as to the respective merits of "wet" and "dry" mash feeding. In dry mash feeding the mixture is available to the birds all the time, dry, in specially designed hoppers, to eat as and when they wish; the plane of nutrition being controlled by making the mixture more or less bulky. Provided the mash is palatable (in the sense defined above) this method has proved quite successful in many large commercial units. Its advantages are—a great saving of labour, the birds never have to wait for their breakfast, and can feed ad-lib without waste, while the shy birds do not get crowded out. This method, or perhaps a combination of it with mash and grain feeding, is well worth considering by those who do not find it possible to be punctual as regards feeding times. Maximum consumption and production cannot be achieved if the birds are sometimes kept waiting and hungry. In either system the last feed at night should be grain or wet mash which can be quickly eaten, so ensuring that the birds go to roost with a full crop. Laying hens should always be given some kind of food during the middle of the day. It is sometimes difficult in the short daylight hours of winter to induce laying birds to eat all they need for maximum production. In fact it is for this reason that the electric lighting of some large commercial units has resulted in appreciably increased consumption of food and production of eggs during winter months.

Wet mash should be only dampened into a moist, crumbly condition, and if skim milk (or whey) is available it may with advantage be used for this purpose. It is preferable not to feed the mash on very hard surfaces, such as concrete or metal, since the birds dislike the jar this gives to their beaks, and no such factor which is likely to discourage the birds from their maximum consumption of food should be overlooked. For the same reason the wooden feeding boards or troughs should not be left sour with fermenting "left-overs, and should provide plenty of room for all the birds (6in. per bird) when feeding. No more should be given in one feed than the birds will clean up in 20-30 minutes.

Green Feed

Fresh green feed supplies iron and lime and most of the essential vitamins, provides the yellow pigment needed for a rich yolk colour and favourably influences the hatchability of eggs. A daily supply is therefore essential; but a fouled grass run plus a few old cabbage stalks must not be regarded as a supply of green feed. Fresh lawn clippings, lucerne, clover, watercress, silver beet, chou moellier or any other of the cabbage family are all excellent. Green feed can be placed in a wire netting rack, but probably more will be eaten and less wasted if it can be chopped or chaffed and placed in troughs. A small amount may be mixed in the mash, although, as already explained, this can easily make the mash too bulky.

Lucerne is the most valuable of all green feeds for poultry, being well supplied in all the minerals they most need. For winter feeding, if fresh green feed is not available, lucerne leaf meal is an excellent substitute. Failing this, first quality green lucerne hay, cut in the young pre-flowering stage, with well preserved leaf, may be used. It can either be ground into a meal or chopped. Poultry cannot digest fibrous material, too much of which only takes up space that digestible food could occupy; hence such fibrous feeds should be used with discretion only if fresh green feed is not available.

Grit and Water

Experiments have shown that birds can be reared successfully without any grit to assist the grinding work of their gizzards; but the same experiments proved that when grit is supplied the birds use up less energy in the process and so make more efficient use of their food. Grit should be supplied in a form such as screened finely crushed "metal." This is not a substitute for shell or limestone grit, which must also be supplied for the different purpose of keeping up the suply of lime for the formation of egg shells. It requires one ounce of shell grit or limestone to supply the lime for 4 egg shells. A mixture of both kinds of grit (gravel and shell) should be constantly before the

birds. Needless to say there should also be an ever-present supply of clean fresh water. Dark combs often indicate a lack of water. If skim milk is provided for the birds to drink (an excellent plan) this should be in addition to fresh water, as the birds should not be compelled to drink milk which they may not want in order to quench their thirst. Digestive troubles may follow if this mistake is made.

Moulting

Feathers, unlike wool and hair, cease growth when fully formed and can only be renewed by moulting the old feathers and growing a new crop, a process which normally occurs once each year in the mature bird. Feathers are composed almost entirely of protein, and make up 25 per cent of the bird's total store of protein. Hence the demand for protein for new feather growth during the moult is unusually heavy, and if this extra protein is not supplied, the birds will lose condition and the moult will be unnecessarily prolonged. Moreover, moulting always puts the birds off the lay for a while since the limited supply of protein cannot be turned into both eggs and feathers. The object then should be to get the birds through this moult and back to laying as quickly as possible by increasing the proportion of the protein concentrates in the ration.

Conclusion

Sound feeding is only one of the lines in the chain of success, and much good and costly feed can be wasted if equal attention is not paid to such matters as draughty and damp houses, insufficient protection from cold wet winds, insect infestation, or undue disturbance, as from nearby dogs or traffic. The laying hen is very sensitive and is quickly put off the lay by faults in feeding and management. Regularity of feeding is of the greatest importance, while sudden changes in the diet have often put birds off the lay or even induced a premature moult. Whether it be on the commercial scale or simply as a means of providing the household with this valuable item in its diet, it is those extra eggs that can be obtained by thoughtful and understanding attention to the needs and habits of the birds that make the keeping of utility poultry a satisfactory and profitable enterprise.

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ELLESMERE GUARDIAN PRINT

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

CARE OF HIDES, SKINS AND OFFAL

Prepared by the Canterbury Agricultural College, Lincoln

Bulletin CHRISTCHURCH, MARCH, 1945. No. 188.

Introduction

Almost all hides and skins sent in by farmers to the stock and station agents or other merchants for sale are graded as "Country" for the purposes of sale classification, and are expected to bring a much lower price than hides and skins marketed by the freezing companies or abattoirs. When selling rabbit skins or deer hides the professional rabbiter or deer culler learns as the result of market experience to make a workmanlike job of the preparation of these hides and skins. The farmer on the other hand often does not see the market reports for "Freezer" or "Butcher" hides and skins and frequently does not realise he is receiving a much lower price than could have been received with proper care. Not only does the farmer lose personally but the country also loses in that "country" hides and skins exported bring a relatively low price and the "country" hides and skins prepared locally either take a longer time and more labour to prepare, through lack of expert attention, or are partly damaged and wasted and result in a smaller or inferior ultimate product. The object of this bulletin is to point out exactly what action should be taken to avoid these losses in the future.

Hides

1. Avoid nicking or cutting the hide when skinning, as this limits the scope of use for which the uncut portions of the hide can be used. Use a sharp knife but do not cut into the hide.

2. After skinning, spread the hide out on the gratings of a shearing shed floor, or elsewhere, laying it flat so as to get rid of all animal heat quickly.

3. As soon as the animal heat has gone wash off all blood, scrape off all fat and dirt and allow to drain. Blood stains may be detrimental to the colour of the hide and blood, fat and dirt make complete salting more difficult, with the result that putrefaction may set in.

4. Drain the water off the hide, lay it flat and salt down. See that there are no parts insufficiently salted. If the salting is done before the animal heat has subsided or if putrefaction of any part through insufficient salting has occurred, the hide will not make a sound leather and considerable loss is incurred.

5. After about two weeks for a grown beast and one week for a calf, hides may be rolled up and sent to market or stored and will remain in good condition. If the hides are rolled up too soon the salt is likely to fall away from the folds and incomplete curing will result.

6. Provided the hide is correctly cured and the above directions

followed, the hides will be properly prepared for later manufacturing into leather at the tanneries, or for export. The farmers should then secure a much better grading and price for their "country" hides.

Sheepskins

1. When removing the skin the knife should be used to the minimum extent, and the ordinary system of punching the pelt away from the carcase should be adopted as much as possible. A very high percentage of pelts are damaged through excessive use of the knife. The result is that the size and shape of the leather which can later be cut out of the cured pelt is reduced.

2. Spread out the skin on the killing battens and remove any blood or lumps of fat. Very little blood or fat should be on the skin if the killing and dressing are done in a workmanlike manner. Any blood that does adhere around the neck should be washed off immediately to avoid staining, and any lumps of fat should be scraped off immediately to avoid improper curing and later deterioration in the quality of the leather. Care should be taken before killing to see that the wool does not become dirty through presence of dags, pieces of grass, manure or straw. If particles of dirt and straw have been allowed to mix in the wool these should be brushed or shaken off.

   Skins should not be salted as the salt reduces the effectiveness of the chemicals used to remove the wool and makes the pulling of the wool more difficult, resulting, possibly, in damage to the grain of the pelt.

3. The skins should be spread out neck to tail on a wire or straight pole. Make sure that the pole is straight and the wires are free from sagging, as this would affect the shape of the skin when dried and make the process of folding for packing difficult. In order to hasten the curing process, the skins may be hung out in the open for the first day or so but then they should be removed and hung under cover to prevent weather staining from rain, hot sunshine or heavy dews. When hanging the skin to dry, the wool on the britch end should be slightly tucked under to prevent curling in and improper drying of that portion of the skin. Similarly, the neck end with the ears attached should be hung evenly over the wire or pole. The trotters should be shanked down as low as possible so as to keep the flaps open. This assists even drying of the skin. It also reduces risk of loss through maggot infestation caused by flies which attack any curled in portions, especially during the summer.

4. When dry, the skins may be sent in to the brokers for sale. Before folding, carefully cut off the trotters using a sharp knife to avoid tearing the skin. Fold the skins by turning in the edges and rolling with the wool outside so that the pelts are not exposed to the risk of damage by bag hooks during transit to the stores.

5. If the skins are kept for any length of time before sending in to the stores it is advisable to paint the pelt with a solution of powder dip, or better still sprinkle with naphthalene to prevent damage by weevils, or other chewing insects.

Offal

In Bulletin 131 dealing with the control of hydatids it was shown that if the tape worm could be eliminated in the dog, then hydatids would cease to exist. To de-

stroy the tapeworm in the dog and prevent reinfestation, two actions are necessary; first, all dogs should be dosed each three months with arecoline hydrobromide. Second, any offal having even the slightest possibility of being infested with hydatids—particularly the lungs and livers of sheep, cattle and pigs—must never be eaten by dogs unless it has been rendered harmless by boiling. To do this, a tin suitable for boiling offal, and a supply of dry wood in a covered box should be placed handy to all killing pens. In the case of isolated killings or where the above method is inconvenient, the offal should be (1) buried so deeply that dogs cannot gain access to it or (2) buried in a small enclosed area covered with netting wire or boxing, (3) covered to protect from flies and hung in a tree away from the reach of dogs. Once decomposition has reached a fairly advanced stage, which may take a week or three weeks dependent on the weather, the hydatids are destroyed.

Conclusion

Careful handling of hides and sheep skins would more than compensate for the extra time and labour involved. That the present methods result in considerable avoidable loss to the farmer and the country can be verified by referring to the brokers concerned. Further instructions on these and other points can be obtained by reading a recently issued booklet, entitled "Wool Marketing and Notes on the Care of Hides and Skins." By strict and regular attention to the dosing of dogs and the prevention of feeding raw offal to dogs, hydatids could be eliminated. At present this disease causes heavy loss to farmers through the reduction in value of edible offal, and is a constant danger to the health of animals and human beings.

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CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

Burning Practice On Tussock Grassland

(Prepared by the North Canterbury Catchment Board)

Bulletin CHRISTCHURCH, APRIL, 1945. No. 189.

According to the Soil Conservation and Rivers Control Act, 1941, the North Canterbury Catchment Board is charged, in common with other Boards, with "Minimising and preventing damage within its district by floods and by erosion." It is empowered, among other things, to "Prohibit the lighting of fires except under such circumstances and subject to such limitations, conditions and restrictions as may be prescribed by the by-laws." The present policy of the Board is to keep land in occupation and production and it does not propose to take any action within its very wide powers without first thoroughly investigating the problem under consideration and without, wherever possible, obtaining the co-operation and advice of the man immediately in charge of the land.

Considering it desirable to formulate a standard of practice on the subject of the burning of grassland the Board invited the assistance of all tussock grassland farmers in its area. A comprehensive questionnaire was forwarded to all such pastoralists and the Board wishes to express its appreciation of the co-operation of the 54 runholders (representing 71 properties of a total of 968,517 acres) who not only completed the questionnaire but in many cases also provided much additional information. Thanks to the interest of the Canterbury Chamber of Commerce and of Lincoln College we have been granted the use of the current agricultural bulletin to publish a summary of the replies received.

Well known to runholders, but perhaps not generally appreciated by the public, is the complexity of the many factors involved when a burning policy is being considered. "Climatic conditions (temperature, rainfall, wind etc.) season of the year, locality (sunny or shady faces, height and steepness of country, if country has bare shingle tops, shingle patches, or slides, fire breaks such as creeks, shingle slides, swamps etc.) soil (sandy to sandy loam or clay) the depth of soil to subsoil or shingle, plant covering (tussock, snowgrass, flax fern, scrub etc.) stock carried (breed of sheep and cattle) pests (rabbits, deer, chamois, geese etc.)." Such complexity makes it obvious that in the long run burning policy becomes an individual problem, for the individual runholder to study and solve on his individual property but with the help of scientific investigation wherever possible.

Only 12 per cent of those replying considered it was unnecessary to burn and most of these were on Banks Peninsula. The most important reasons given for burning were to renew rank dead tussock, to keep down scrub, to give better access for grazing and mustering and to reduce the danger from accidental fires. This is what the runholders themselves say: "Without burning on my country, matagouri would flourish to such an extent that it would be impossible for sheep to graze and almost impossible to ride a horse." "I burn rough tussock and other grasses which otherwise rot down and smother trefoil and clover." "Brown top has to be burned or it is useless." "Sheep do not thrive in tall wet tussock. It shades off the bottom grasses which have no nutriment without the sun's rays." "I burn tussock as little as possible but I find it necessary sometimes in order to rejuvenate dying tussocks and to check excessive growth in swamps." "I do not find it necessary to burn tussock but without burning fern it becomes so high that I can't muster sheep." "I burn only when sheep cannot get access to feed or when the density of the vegetation makes it dangerous from the risk of acci-

dental fires." "I endeavour to burn only manuka and matagouri and then only when they become so dense that is is difficult to see sheep therein or muster them through—this causes loss of wool and mismothering of lambs." "I have cut out all burning above 3000 feet and other burning as much as possible." "In the drier areas we seldom burn especially on steep sunny faces or if the soil is light." "I have stopped all burning of tussock or snowgrass on hill or flat and burn only in swamps." "My burning has been reduced by 75 per cent but I am afraid of a large burn through increased cover." "In my opinion much of our high country can be better improved by proper burning and surface sowing than by no burning." "I never burn any high country or any broken shingly country." "It is a mistake to burn snowgrass. It sets up erosion." "I burn only when the ground becomes so matted with rubbish that the stock will not graze." "On no account do we burn any country infested with rabbits." "Fires are never allowed to run high up the hills and snowgrass is never burned."

The majority of the replies stressed the fact that the tendency was towards less burning. There is almost unanimous opinion in favour of spring burning, August and September being the all-important months. One man likes to wait until the tussock is "greenish." "It then burns like a cone but an earlier burn produces a saucer-shaped tussock crown which will rot away." "I require the ground to be wet and just enough wind to carry a fire." "I burn after rain, with dull weather and a light south-west wind." "I like an easterly or other light wind with prospects of a still frosty night." "I burn when the weather appears to be set-fair." "Burning in a nor'west wind on a sunny face can burn the roots and do a great deal of harm." "There is still too much burning in nor'west weather. Fires are then apt to sweep over country burned a season or two previously with disastrous results." Some men prefer a "good" wind, if the ground is moist, "because it burns off quickly." Some prefer a nor'west wind for scrub "so as to drive the fire up the stems and ensure a kill." "When it is possible, it is safer to light fires at the top of a hill and let them burn down; or to light them so that they burn back against the wind. When this can be done they must be lit earlier as they burn much slower." "I burn only when the snow is on the hills above so that the fire will not travel too high." **"I may wait several years to get the right conditions."**

Most thoughtful burners prefer the afternoon for setting a match and some wait as late as 5 p.m. Fires lit in the spring in the late afternoon cannot burn long and the danger of a fire "getting away" is much reduced. As far as the replies were concerned annual burning is a thing of the past. Frequencies of once in three to five years are sometimes mentioned but the tendency seems to be towards longer periods between fires. Nearly half the high-countrymen concerned burn only at intervals of from 10 to 20 years. One said, "I burn only once in 20 years but never if possible."

There is fairly general agreement that burning results, at least temporarily, in improved quality of the feed, and that by this means "stock can be attracted to the shady faces." Other advantages claimed for burning are, "We get more efficient mustering and less hogget mortality;" "Lambs do better on burned country;" "If we altered our present practice, carrying capacity would drop materially;" "On scrubby country it improves the carrying capacity;" "Burning kills grubs and caterpillars which destroy the tussock;" "Clovers do better because of the removal of shade;" Burning on this property increases the grasses which form a close surface cover and knit the top soil together as opposed to the deeper but more open cover provided by tussock. The newer vegetation is less inflammable and is relatively undamaged by fire;" "If carefully burned the tussocks are more vigorous for some time after burning."

There is much evidence of the disastrous effects of "accidental" fires resulting from the activities of picnickers, railway engines, musterers, deerstalkers, careless persons, and others on country which had not been burned to keep down rank vegetation. "I have seen non-burning in this district with disastrous results from wide-spread fires burning country so badly that it took years to recover. Such fires are a greater threat to erosion than sensible burning." "Systematic burning is necessary as a safeguard against having a property completely burned out." "If I did not burn, my country would become a mass of scrub and rank tussock. The danger of fire would be appalling; some fool would drop a match and the

result would be disastrous."

There is much useful evidence of improvement in various ways by a reduction in the frequency of burning (except of scrub), by changes in management following a burn, or changes in management designed to avoid burning. "Through ceasing burning of tussocks, we have a marked improvement in sheep feed during very dry periods. Small slips and guts are becoming less noticeable. We carry no more sheep but we have a more even distribution of feed throughout the year." "After 21 years of non-burning of tussock, I still carry the same number of stock." "I have tussock country which has not been burned for 40 years—it has good feed on it today and still does not need burning." "We do not burn at all except for small patches of scrub and our carrying capacity has been maintained. We spell winter country block about for six months and have left one summer block unstocked for six years." "If all unnecessary burning were stopped the country would improve." "It is 40 years since my last fire. What was bare country then is now in good tussock and I have doubled the carrying capacity." "I could see my hill country deteriorating under burning and have completely stopped same with beneficial results." "Overstocking and overburning are the chief causes of erosion. Properties that have escaped both are improving; they are seeding themselves."

Many runholders have found that cattle help considerably in reducing the necessity for burning. "I formerly had to patch burn tussock as a precaution against getting burned out in summer or autumn. Now I have plenty of cattle the tussock is fairly safe." "I have found cattle most useful where the tussock grows so densely that the bottom feed remains wet and the sheep will not stay on." "Cattle are not so hard on tussock as burning and since I have run them I have been able to cut out my burning policy." (Others have found that fencing difficulties prevent their keeping cattle on the necessary areas).

There is general appreciation of the fact that unless extreme care is taken freshly burned areas may be damaged by overstocking too soon after a burn, especially a small one. "Sheep eat out the burned patches to such an extent that the surface is damaged by heavy rains and winds." "If care is not exercised in grazing a new burn, the ground may still be bare by the following winter and will be exposed to damage by frost." "Growth from fresh burned tussock and finer grasses is grand feed for stock especially wet ewes and in some cases will even fatten lambs on their mothers, but taking a long view, feeding it, though tempting, is a bad policy." "Where the portion burned is only a piece of a block, when the tussocks and finer grasses and herbs start to grow after the fire, the stock pack on the burned portion and punish the young plants to such an extent that many of the smaller and finer varieties never recover." "If winter country is burned it should be spelled at least one year, preferably two, to recover and re-seed. If there is no suitable fencing or stock boundary to enable this to be done, the stock should be reduced by half." "I burn as little as possible but if I do burn I spell the country afterwards as much as possible until it has had time to pick up." "The worst result of burning is the temptation to carry more stock for a year or two after burning." "If the burn has been too small in relation to the number of sheep on the block, the plants may be killed out." "The chief harm in burning is the subsequent heavy stocking. Only sub-division can control this but the cost is prohibitive. Nor have we security for such improvements." "Burning and stocking may prevent seeding of tussock."

Cropping on suitable country is being used indirectly to assist regeneration of tussock. "I have been attempting to improve the native cover by reducing the stocking by growing winter feed. This has improved the winter country. The higher and harder summer country is a more difficult problem as erosion in the form of running shingle in particular has reached such a stage that even the complete de-stocking of it would do very little towards making an improvement, though it may help arrest it on the lower slopes."

This realisation of the erosion danger is evident in a large number of the replies. "Even today I think burning is too often looked on purely as a means of producing food with no thought of erosion." "Burning in years past has been one of the greatest causes of loss of carrying capacity at the present time owing to erosion starting." "I have noticed that the burning of the native scrubs in the upper reaches of the rivers has a very bad effect on the country allowing the

surface to run to clay and slide away." "The great cause of soil erosion is fires getting away in a hot summer, getting down to the roots, burning the guts out of the land and leaving the ground bare for a good downpour to wash the surface." "As a result of 30 years' experience I believe that burning of tussock encourages surface soil erosion." "Erosion in the back country is caused by overstocking of burned country." "After nearly 30 years' experience in managing and supervising high country I believe some country can thrive and be safely burned without fear of erosion while other properties should never be burned. I have seen many thousands of acres ruined for all time through overburning and overstocking." "A run-off is increased following a burn." "As a result of burning, tussocks are badly weakened on my country owing to removal of the natural humus and the exposure of the surrounding soil to frost-lifting and subsequent erosion."

The increased palatibility of tussock following a burn and consequent damage by grazing is considered by many as an objection to burning. These men look on the tussock, not as a pasture plant, but as a shelter for the smaller but more important grazing plants and consider destruction of tussock may ultimately destroy the pasture. Some run-holders regret the destruction of tussock shelter when it comes to lambing.

There is fairly general agreement that burning, especially if frequent, results in an increase of such unpalatable native plants as Maori onion, cotton plant, and bidi-bidi at the expense of useful plants and that introduced grasses such as brown top and sweet vernal are also increased.

There is an agreement, too, that there is little alternative to burning except the use of definitely controlled grazing following on subdivision, a general reallocation of winter and summer country, or in places the use of cattle. As all of these involve fencing the runholders themselves can do little.

After the replies to the questionnaire had been carefully analysed, the results were discussed at a conference of representative runholders and members of the Catchment Board. At a subsequent meeting of the Board, the conclusions of this conference were discussed. The Board, while realising that it will eventually have to investigate and experiment with all possible alternatives to burning, decided to publish for the information of all concerned its present opinion on the subject. The statement adopted was as follows:—

(1) The Board recognises that under existing conditions of tussock grassland management it is sometimes necessary to burn for two main reasons; to remove rank and dead tussock and to keep scrubby growths in check.

(2) On the evidence of runholders, however, burning should be resorted to only after due consideration of all possible alternatives and then—

(a) only in spring (except for manuka scrub on wet country).
(b) preferably in August or September.
(c) only in the afternoon (preferably after three o'clock).
(d) with the ground and base of tussocks damp.
(e) preferably in calm or gentle easterly weather with prospects of heavy dew or frost (The nor'wester must be avoided).

(3) Runholders admit that even restricted burning may—

(a) weaken the growth of the tussock plants especially if grazed within the few months after the burn,
(b) restrict seeding,
(c) destroy humus and hence lower fertility,
(d) temporarily — at least — bare the ground and thus encourage weeds and soil erosion,
(e) provide a suitable breeding ground for rabbits.

Therefore burning should be practised as little as possible, and only after careful study of all the factors involved. The Board is reluctant to support any policy of coercion and prefers to rely on the cooperation of the man directly responsible for the maintenance of the productive capacity of the land.

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ELLESMERE GUARDIAN PRINT

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

RED CLOVER AND BUMBLE BEES

Prepared by the Canterbury Agricultural College, Lincoln

Bulletin CHRISTCHURCH, MAY, 1945. No. 190.

Red clover is an important seed crop in New Zealand, and from five thousand to eleven thousand acres are harvested annually for seed. Practically the whole of the seed is obtained from South Island areas, chiefly Canterbury, Otago, Marlborough and Southland. The average yield of seed, calculated over a period of years, approximates 166lb. per acre. From the farmers' point of view the crop is a very uncertain one, and the average seed yield must be regarded as unduly low. Various opinions are advanced to account for the uncertainty of the crop and for the low yields. The three factors usually regarded as the most adverse are (1) unfavourable weather conditions, (2) damage by insect pests—the small, red thrip in particular, and (3) a great scarcity of efficient cross-pollinating agents.

Red clover is practically self-sterile and seed setting is dependent on cross-pollination, accomplished in the field almost entirely by certain insects. There is a good deal of evidence to support the view that the scarcity of cross-pollinators is the chief adverse factor and that the others are of secondary importance except insofar as the weather may affect the numbers and behaviour of the cross-pollinating insects. Adverse weather conditions and damage by insect pests may cause some reduction in yield, but the fundamental requirement is pollination.

Controlled experiments, supported by observations in the field, have been carried out in this and many other countries to discover the efficiency as cross-pollinators, of the chief insects which visit red clover crops to collect pollen and nectar. The evidence collected from the various countries shows that only bees—both bumble bees and honey bees—are of any real consequence in pollinating red clover flowers. It has been proved conclusively that certain types of bumble bee are extremely efficient in red clover pollination, whereas others, while pollinating a certain percentage of flowers may cause a considerable amount of damage to the crop by biting a hole at the base of the corolla tube (at the base of the tubular floret) and sucking the nectar through this hole. Any floret cut at the base in this manner fails to set a seed. The part played by honeybees in red clover pollination is still very far from being clearly understood. It is known that honeybees prefer other nectar-producing flowers to red clover. This is due to the difficulty which the honey bee experiences in reaching the nectar. The red clover floret is approximately 10 millimetres in length and the nectar rarely rises to a greater height than 1 millimetre so that the bee with a tongue which is shorter than 9 millimetres will experience difficulty in extracting the nectar in the normal manner. The tongue of the honey bee, irrespective of variety, measures less than 7 millimetres. Hence the honey bee may reach the nectar in occasional short florets and also in longer florets when certain weather conditions prevail which encourage a copious nectar flow. It is contended that honey bees work red clover better during hot, dry days followed by cold night conditions which are regarded as conducive of greater nectar production. Honey bees will also visit red clover and sip the nectar through the holes cut in the base of the florets by short-tongued bumble bees, but when they do this they do not effect pollination of the flowers.

Some European investigators hold the view that red clover is pollinated almost exclusively by certain species of bumble bees. For ex-

ample, R. D. Williams, of the Welsh Plant Breeding Station, states, "In this country red clover is cross-pollinated almost entirely by means of certain species of bumble bee with the assistance of honey bees in some seasons. Although butterflies, moths and other insects may sometimes be found visiting the flowers, they are unable to effect cross pollination." A publication issued by The Plant Breeding Station in Finland states: "Under natural conditions pollination is effected almost entirely by bumble bees, Bombus distinguendus in particular." This species has not yet been introduced into New Zealand. On the other hand many American investigators claim that the honey bee is of great value in the pollination of red clover, and some would regard it as being more effective than the bumble bee because of its greater numbers. Hence the prevalent opinion amongst beekeepers in this country would seem to be well founded, that honey bees work red clover and effect a considerable amount of pollination when no white clover or other preferred food is available to them. To obtain the greatest benefit from honeybees it is therefore recommended that hives be placed in the middle of red clover stands rather than on the headlands.

The different varieties of honey bee and the four or five species of bumble bee present in this country have been introduced at one time or another. Although native bees are present in New Zealand, none of these are of the type that congregates in large colonies and are therefore not effective for pollinating clover. Honey bees were first introduced in 1839. After many early attempts had failed, the bumble bee was successfully introduced in 1885 when 90 queens were liberated at Christchurch and became established. These multiplied and bumble bees soon spread throughout the country. In 1888 they were observed in Wellington and in 1890 in Auckland. Prior to the introduction of bumble bees, red clover did not usually set seed in sufficient quantities to justify harvesting it, although the honey bee had been here since 1839. Within a short time of 1885 the number of bumble bees increased enormously and red clover seed yields went up correspondingly. After a number of years the bumble bee numbers declined sharply and in many areas where they were once common they became almost rare, and yields of red clover seed declined with them. Ever since then that position has altered very little.

Unfortunately the bumble bee is not amenable to domestication like the honey bee. The large individuals seen on the wing in the spring time are fertilised queens which have spent the winter in some safe retreat about a grassy bank, under a hedge, in sod fences, or about an old haystack. Each queen sets about building herself a nest at the end of an underground tunnel, and when completed, stores a quantity of pollen and honey to supply her own and her offspring's needs. In due course a colony is built up and all the individuals produced during the summer are workers which take over the duties of the nest and the collecting of pollen and nectar in order to enable the queen to devote her time to egg-laying. A bumble bee colony, even in the height of the season, rarely exceeds about 300 individuals. Towards autumn, there is produced in addition to workers, young drones and queens. These sexual forms leave the nest and each young queen when fertilised seeks out and provisions a safe winter retreat. All other individuals perish before the winter is over and only the young queens survive to start fresh colonies the following spring.

At most there are five species of bumble bee present in New Zealand. One of these is so rare that it may be left out of account altogether. Of the remaining four species two are long-tongued and always pollinate red clover when they visit it. Two are short tongued and have difficulty at times in reaching the nectar and they may therefore acquire the vicious habit of biting through the base of the corolla tube and not only fail to pollinate that flower but prevent it setting seed. The same trouble is always experienced with beans. The two long-tongued forms are very similar to each other in habit and appearance. The two short-tongued forms, while differing somewhat from the long-tongued, resemble each other closely in behaviour and colouring. By careful observation it is possible to distinguish the long-tongued from the short-tongued. The long-tongued are either black all over, or the black may be relieved by yellow cross-bands. There is, however, never more than one yellow band across the back between the neck and the waist. The

short-tongued forms are black with yellow cross bands and there are always two yellow bands between the neck and waist. It is a matter of considerable moment to the seed grower to discover whether the useful bees are sufficiently numerous in this country to deal effectively with all the clover crops grown for seed. On the average, red clover has about 105 florets per head. Normally, only about 40 of these produce seed. There appears to be no reason why this number could not be at least doubled. When working red clover, bumble bees can fertilise 30 florets per minute. It has been estimated that an average stand of red clover has about 35 to 40 heads per square foot in flower during the main pollination period which may last about 14 days. On this basis, an acre of red clover has about 160 million florets actually in bloom during this 14-day period. To pollinate this enormous number of florets, about 640 bumble bees working continuously for 10 hours a day would be necessary. If unfavourable weather conditions curtail bee activities, a proportionately greater number of bees would be necessary. In seed growing centres hundreds of acres of red clover are grown within a comparatively small area, therefore the number of bees required to pollinate the crops of each centre must be enormous.

On farms where red clover is to be grown for seed, bigger average yields are likely to be obtained if it is grown regularly from year to year and also if grown in a series of relatively small paddocks widely separated, rather than in one big area.

In order to derive the greatest benefit from the limited numbers of bumble bees present it is essential that the time of flowering of the seed crops should coincide with the maximum numbers of long-tongued bees. The short-tongued species appear earlier in the spring, reach a maximum about mid-January and then begin to decline. The long-tongued species appear later in spring, reach a maximum about mid-February and then begin to decline. Hence red clover crops in full flower from early February onwards may be expected to benefit most from the useful long-tongued bees and suffer less from the flower puncturing activities of the short-tongued bees. To this end, crops for seed production should not be shut up too early.

There is a current belief that bumble bees fail to build up large colonies and to become really numerous in this country because of the scarcity of suitable food in winter and early spring. But it must be noted that the bees introduced into New Zealand were British species, and in Britain bumble bees go into their winter retreat, remaining in a thoroughly dormant state for several months. One would practically never see a bumble bee on the wing in Britain during the months of November, December, January or February. When they awaken in spring there is likely to be sufficient food for their requirements owing to the abundance and variety of the spring flowers to be found in that country. On the other hand the New Zealand climate with its occasional hot days throughout the winter tempts the bumble bees to leave their winter retreat and use up their food supply. In Canterbury, bumble bees may be seen on the wing during every month of the year, not excluding May, June, July and August. When they leave their retreat in the spring time and commence to build up their colonies they probably experience great difficulty in finding a ready supply of nectar owing to the scarcity of flowers.

Gorse provides abundant pollen but no nectar; however, gorse hedges provide abundant safe and dry nesting places. Tree lucerne flowers in late winter and early spring and is a rich source of nectar eagerly sought after by bees. Farmers who grow red clover for seed would be well advised to plant tree lucerne freely about their farms and homesteads.

A very strong case could be made out for introducing more species of long-tongued bumble bees to New Zealand. As indicated previously, the average red clover seed yield is approximately 166lb. per acre. This compares very unfavourably with that of some European countries which are much less favourably situated climatically. The average yield for the whole of Sweden during the 10-year period 1921-31 was 251lb. per acre. Even Finland, situated as it is between latitudes 60 and 70 degrees North, with spring and summer seasons of very short duration, can produce red clover seed successfully. In Finland there are at least nine species of bumble bee which visit red clover flowers.

The introduction to New Zealand of additional long-tongued species

could result in no harm and would in all probability greatly increase the annual yield of red clover seed and reduce the uncertainty which exists at the present time. There is a wide range of suitable species to choose from in European countries like Finland, Norway, Sweden, Denmark and Great Britain, as well as in North America. The advisability of introducing a wider range of such species to New Zealand might well be strongly supported by farmers and other organisations.

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CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

Canterbury Dairy Farm Budget

Prepared by the Canterbury Agricultural College, Lincoln

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INTRODUCTION

A budget is an estimate of income and expenditure based on a predetermined farming plan. Such estimates of farming operations are made for various purposes. The value to a farmer of being able to budget for himself lies largely in the fact that in order to do so successfully he must draw up a farming plan.

In this bulletin it is intended to give an example of a hypothetical dairy farm budget for Canterbury to help and encourage farmers to budget for themselves, but the particular example given must not be taken as applying exactly to any one actual farm. In subsequent bulletins budgets of mixed cropping and sheepfarms will be outlined.

A brief description is given of the land, details and values of the buildings, an inventory of livestock and plant and machinery, and an estimate of the capital involved.

DESCRIPTION OF LAND

The land is a sixty-five acre block suitable for dairying. Potatoes, lucerne, and an area of chou moellier and mangels for winter feed and barley for pigs are grown. In this example the farm is considered to be suitably subdivided, sheltered, drained and watered, and prices taken are on a "going concern" or standard value basis.

CAPITAL INVOLVED

	£
Land (bare): 65 acres at £30 per acre	1950
Buildings (at valuation): House and garage £800; milking shed, separating room and wash-up room £150; shed £80; pig styes £40	1070
Land and buildings	£3020

Equals approximately £46 10s. per acre for the farm.

Livestock: 31 dairy cows at £10 10s., £325; 6 rising 2 yr. heifers in calf at £8, £48; 7 rising 1 yr. heifers at £3, £21; one bull £10; 2 three-quarter draught horses at £10, £20; 3 sows at £4, £12; one boar at £4	£440
Plant and Machinery: Dairy Plant: 3-cow milking plant and motor £90; 75-gal. separator and motor £30; water heater, electric, £12; 4 ten-gallon cream cans at £2, £8; water pump and motor £10; milk pump £5; milk and calf feed buckets (six at 5s.), milk drums at piggery (six at 5s.), £3; wash-up tubs £2	£160
Implements: Horse plough, 2-fur., £15; Grubber £15; drill £25; clod crusher £3; heavy tyne harrows £8; chain harrows £6; mower £18; tedder £22; stacker £30; topdresser £20; spring cart £10; sundry tools and harness £25	£197
Total Capital Requirements	£3817

Summary of Capital Requirements:

	£
Land and improvements, including buildings	3020
Livestock	440
Dead stock (plant and implements)	357
Total	£3817

The capital required per cow equals $\frac{\text{Capital}}{\text{No. milking cows}}$ equals $\frac{3817}{31}$ equals £123 approximately, is more for this hypothetical farm than generally considered necessary for "average" dairy farms by the dairy industry in 1934. One reason for this is that in Canterbury the majority of dairy farms are purchased with a view to the carrying on of

some cash cropping and the per cow capital requirement of the majority of Canterbury dairy farms is much greater than the now almost out of date figure of £75 per cow accepted by the dairy industry.

THE PLAN

Before actual estimates can be made it is necessary to outline in detail, using figures where possible, the main points of the farm plan. In other words a programme must be worked out. All that is known to this point is that the area of the farm is 65 acres on which it is proposed to milk 31 cows and carry replacements, and which has an adequate complement of improvements in the form of buildings, fences, drains, etc., and is suitable for the growing of potatoes, barley, and lucerne in addition to dairying.

Winter Feed: The first consideration is to determine the quantities required.

One and a half tons of good hay and two and a half tons of chou moellier and mangels per milking cow are sufficient for the total herd including replacements (see "Feeding Dairy Cows", Bulletin No. 127).

Therefore the total requirements will be: Hay (one and a half tons x 31) 47 tons, chou moellier and mangels (two and a half tons x 31) 78 tons.

The hay could be provided by thirteen acres of lucerne. On average there would be one acre being renewed each year, leaving twelve effective acres yielding four tons per acre, equals 48 tons.

The chou moellier and mangels could be provided by growing one acre mangels (40 tons per acre) 40 tons and 2½ acres chou moellier (20 tons per acre) 50 tons, giving a total of 90 tons.

Those few extra tons above the cattle requirements would be fed to the pigs.

CROPPING PROGRAMME

It is necessary to work into a cropping programme the provision of the above winter feed requirements and also to make provision for the renewal of the lucerne stand. The cash cropping must fit into the scheme also. Such a programme could be:

One acre old lucerne, 5 acres old pasture—2½ acres chou moellier, 1 acre mangels, 2½ acres potatoes —1 acre lucerne, 5 acres barley sown down.

Thus each year five acres of old pasture and one acre of lucerne are ploughed up and one acre of lucerne is renewed and five acres of new pastures are sown under barley, two and a half acres of potatoes are planted each year, and three and a half acres of mangels and chou moellier are sown for winter feed.

THE BUDGET

Now that the general farm management programme has been decided upon it is possible to draw up an estimate of how the plan will work out financially if it should be actually put into practice. In other words a budget can now be prepared. It is the supporting details to a budget, however, which are all important, and following this budget each item will be fully explained. It is in these explanations that many of the finer points of management will be revealed, and, it is hoped, much that will aid the farmer in working out his own figures.

Estimated Income:

Butterfat £637; pigs £129; calves £12; cull cows £21; potatoes £144; barley £37; rebate on sacks £2 - -	£982

Estimated Expenditure:

(all estimates are to the nearest pound)

	£
Working Expenses: Stock purchases £10; stock foods £1; fertilisers £23; lime £25; seeds £40; sacks £18; twine £2; dairy expenses £19; veterinary expenses £7; freight and cartage £37; electricity £20; motor expenses £13; accountancy and legal £6; repairs and maintenance £42; phone and mail £6; general £10 - -	279
Wages: Casual labour £34; harvesting labour £24; contract work £37; keep for casual workers £18; wages of management £325 - -	438
Overhead: Rates £14; land tax £4; insurance £9; depreciation £53; interest, live and dead stock, £40; interest, land, £136; surplus £9 - - -	265
	£982

SUPPORTING DETAILS

Each item in the budget will now be fully explained and enlarged upon in order, commencing with the income.

Butterfat:

Thirty-one cows less one for family use equals 30 at 260 lbs. butterfat per cow, equals 7800 lbs. at 19.6 pence per lb., equals £637.

Pigs:

For budgeting purposes, with pig meat at 8½d. per lb. and where meat meal is bought at say £15 per ton on the farm, the net returns from pigs works out at about 2½d. per lb. of butterfat produced.

Where pig foods are home grown the return is of course greater. The acutal working out of returns on this farm will reveal some interesting information. For bacon-pork production one sow per ten milking cows is an efficient ratio. Each sow is required to farrow twice a year and seven pigs sold per farrowing can be reasonably achieved. Thus with 31 cows, three sows could be carried, each producing two litters per year, giving a total of six litters annually.

With the majority of the cows calving in August-September efficient utilisation of the skim milk will require that two sows farrow in May and their litters be sold as baconers the following November and December and one sow farrows in June, the litter being sold as porkers in October and November. The two sows which farrow in May, farrow again in November and the other sow in December, these three litters being reared to the porker stage and sold in March and April.

Thus of the six litters reared each year two will be sold as baconers and four will be sold as porkers at weights approximately as follows:

Two litters, fourteen baconers at 130 lb. equals 1820 lb.; four litters, twenty-eight porkers at 65 lb. equals 1820 lb.; total pig meat sold equals 3640 lb.

$$\frac{\text{3640 lb. pigmeat}}{\text{7800 lb. butterfat}} \times \frac{100}{1} \text{ equals}$$

46 lb. of pig meat sold per 100 lb. of butterfat produced. This figure falls within the generally accepted standard efficiency range of 40-50 lb. of pig meat sold per 100 lb. butterfat.

Receipts from pigs equals 3640 lb. at 8½d. per lb., equals - £129

Fourteen baconers at £4 12s. equals £64 8s.; 24 porkers at £2 6s. equals £64 8s.; total pig meat sold equals - - - £129

Calves:

Only normal replacements are kept for rearing. The average annual replacement rate is about 20 per cent; therefore, sufficient heifer calves must be reared to ensure 20 per cent of the herd being available as two-year springing heifers, i.e. 20 per cent of 31 equals six springing two-year heifers. To allow for deaths, say one, up to the two-year stage, seven heifer calves must be reared annually. Assuming a 90 per cent calving there would be

$$\frac{90}{100} \times \frac{31}{1} \text{ equals 27 calves}$$

born alive each year, of which seven are reared, leaving 20 to be sold as bobby calves at the gate.

Twenty at 11s. 6d. equals £12.

Cull Cows:

With six two-year heifers going into the herd each year and allowing for one herd death, there must be five others sold if the herd number is to remain at 31 milking cows. Of the five sold, three will probably be sold as "boners" and two as "fats".

Three boners at £3 each equals £9; two fats at £6 each equals £12; total from cull cows equals £21.

Potatoes:

2½ acres potatoes at 9½ tons total yield per acre: Total yield

7½ tons table equals - 18 tons
1½ tons seed equals - 3¾ tons
½ ton pig equals - 1¼ tons

Half the seed requirements might be kept each year and the other half "bought in". The pig potatoes and surplus seed, four tons in all, would be fed to the pigs.

Potatoes for sale: 18 tons at £8 per ton f.o.b.s.i. ("reds" at £7 15s. and "whites" at £8 5s.) equals - - - £144

Barley:

Five acres malting barley at 45 bus. per acre equals 225 bus.; less requirements for pigs, 89 bus.; giving 136 bus. for sale at 5s. 6d. per bus. ex stack f.o.r.s.e - £37

Rebate on Sacks:

It will be noted the barley is sold sacks extra and a rebate of 1s. 4d. per sack is made to the farmer.

136 bus. at four bushels per sack equals 34 sacks; 34 sacks at 1s. 4d. equals - - £2

ESTIMATED EXPENDITURE

Stock Purchases:

Include the cost of purchasing replacements not bred on the farm.

Bull:

In a herd of 30 cows it is a practice to purchase a "yearling"

bull (fifteen months) every second year.
Purchase price £15; sold two years later as a boner £5; leaving £10 as the cost for two years. Annual cost equals - - £5

Sows and Boar:

The three sows and boar will have to be replaced on average once in four years. At, say, £6 per head the annual stock purchase charge for pigs will be £6, less, say, £3, being the proceeds from the sale of sow or boar as chopper. Annual cost - - - £3

Horse:

The horses are depreciated at 10 per cent, equals - - £2
Total stock maintenance costs £10

Stock Foods:

The nly stock food purchased is meal for the calves, though at this point the total pig requirements and their provision will be considered.

Calf Meal:

Say 10lb. meal per calf at 2d. per lb. Seven calves equal 70 lb. meal at 2d., equals - - £1

Pig Food Requirements:

Pig foods are commonly expressed in terms of barley meal units, so that different types of food can be readily compared and a suitable ration easily computed. A barley meal unit is 1 lb. barley meal or its equivalent equals one gallon skim milk, equals 10 lb. mangels, equal 4 lb. potatoes.

For one sow and litter of seven to bacon stage 6055 barley meal units are necessary. Similarly for a sow and litter to the porker stage 3360 units would be required. The requirements for a boar for twelve months are 2000 units.

For the well established figures in the matter of feed requirements for pigs, see "Pig Production", Bulletin No. 62.

The total requirements for this particular budget can now be readily estimated:

2 sows and bacon litters at 6055 units each equals -	12,110
4 sows and pork litters at 3360 units each equals -	13,440
1 boar equals - -	2,000
Total barley meal units required equals - -	27,550 Meal units

The Supply:

Milk, 30 cows at 540 gallons	16,200
Barley, 1¼ lb. per 1 lb. pig meat sold equals (3640 x 1¼), equals approximately 4450 lb., equals 89 bushels	4,450
Potatoes, 4 tons (seed and pig): 4 x 2240 and divided by 4 equals - -	2,240
Mangels, 12 tons (surplus from cows): 12 x 2240 and divided by 10 equals -	2,688
Grazing, say 2000 units -	2,000
Total barley meal units available equals - -	27,578

Thus the supply available is sufficient for the requirements.

Fertiliser, Lime, and Seeds:

These three items can be conveniently worked out as under:
One acre mangels:
5 lb seed at 4s. per lb. equals £1; 3 cwt. super (4 cwt. reverted super) per acre; 1 cwt. lime.
Two and a half acres chou moellier:
3 lb. per acre equals 9 lb. at 3s. 7d. equals £1 12s. 3d.; 5 cwt. super; 5 cwt. lime.
One acre lucerne:
16 lb. at 2s. 6d. lb., £2; 2 cwt. super (used as reverted super); 20 cwt lime.
Two and a half acres potatoes:
2 tons seed and 1 ton from own crop equals 1¼tons at £14 10s. per ton, £18 2s. 6d.; 8 cwt super (equals 3 cwt per acre).
Five acres barley sown down:
8 bus. barley at 7s. bus., £2 16s.; 10 cwt super (2 cwt. super per acre); 100 cwt lime (1 ton per acre).
Pasture mixture per acre:
15 lb. "P.P." perennial rye at 16s. per bus., 12s.; 8 lb. cocksfoot at 3s., 24s.; 5 lb. Italian rye at 10/- per bus., 2s. 6d.; 4 lb. red clover at 2s. per bus., 8s.; 2 lb. "P.P." white clover at 3s. 6d. per lb., 7s.; cost per acre £2 13s. 6d. Five acres at £2 13s. 6d. per acre equals £13 7s. 6d.
Total Seeds - - - £40
Topdressing:
Lucerne. 12 acres: 12 cwt. super (1 cwt. per acre); 120 cwt. lime (10 cwt. per acre).
Pasture, 50 acres: 50 cwt. super (1 cwt. super per acre); 250 cwt. lime (5 cwt. per acre).
Total Fertiliser: 90 cwt. (4½ tons at £5 "on farm") equals - £23
Total Lime: 496 cwt. (25 tons at £1) "on farm" equals - £25
(see Bulletin No. 156, "Establishment of Permanent Pastures in Canterbury".)
Sacks for Produce sold:
Potatoes (12 sacks per ton): 18 tons x 12 equals 216 sacks at 1s. 4d., £14; barley (4 bus. per sack), 136 bus. equals 34 new sacks at 1s. 6d., £3; replacement sacks for own use for potatoes

and barley for pigs, say 20 per annum at 1s., £1; total sacks £18

Twine:

Seaming twine to sew 34 sacks barley for sale, plus 25 for own use equals 2 hanks twine at 2s., 4s.; binder twine to reap 5 acres barley (say 5 balls), to sew 276 sacks potatoes (say 2 balls), 7 balls binder twine at 4s., £1 8s. total twine - - - £2

Dairy Expenses:

This item covers sundry purchases such as cow covers, teat grease, separator oil, nails, staples, handles for tools, weed killer, washing soda, rubbers, brushes, etc., etc., equals 12s. per cow milked, equals 31 x 12, equals - - - - £19

Veterinary Expenses:

Allows for the cost of drenches, licks, salts, disinfectants, douches, medicines, and occasional veterinary services, equals 4s. 6d. per cow milked, equals 31 x 4s. 6d. - £7

Freight and Cartage:

In order to estimate this item, it is assumed the farm is four miles from the nearest railway station and shopping centre and twenty miles from Addington.

Cartage to Railway Station:

216 sacks potatoes at 6d. each; this figure includes 1d. per sack to cover loading sacks from rows in the paddock, equals £5; 34 sacks barley at 5d. each equals £1.

From Railway Station:

Lime and manure, prices "on farm"; 1¼ tons seed potatoes, equals 16 sacks at 5d. each, equals - 10s.

Cartage of Sundry Purchases:

Oil fuel, timber, sacks, etc., say £5 10s.

Cartage to Addington:

57 pigs at 2s. 6d. - - £7

Freight:

F.O.B. charges on potatoes at 1s. sack (216 sacks at 1s.), £11; seed potatoes (1¼ tons), and sundries, say - - - - £5

Droving - - - - £2

Total Freight and Cartage - £37

Car for Farm Purposes:

Say one trip to local village (four miles) per fortnight and one trip to Christchurch (twenty miles) per month at 4½d. per mile, equals 688 miles at 4½d., equals - - £13

Accountancy and Legal:

Includes the cost of preparing Social and National Security and Income Tax returns, return of land, and minor legal expenses, say £5

Repairs and Maintenance (all repairs on **average annual** value):

Buildings:

House and garage, 1½ per cent of £800, £12; milking shed, 2 per cent of £150, £3; implement shed, 2 per cent of £80, £1 12s.; pigstyes, 4 per cent of £40, £1 12s.; total £18 4s.

Plant and Machinery:

Milking machinery, 7 per cent of £90, £6 6s.; separator motors, pump and heater, 2 per cent of £60, £1 4s.; implements and harness, 5 per cent of £207, £10 14s.; total £18 4s.

Fencing at 9d. per chain: say two chains per acre, 70 acres equals 140 chains at 9d., £5 5s.

Total repairs and maintenance £42

Phone and Mail, say - - £6

General:

An item to cover odds and ends not mentioned - - - £10

Casual Labour:

One man for two months (May-June) to allow owner one month's holiday and to help with harvesting potatoes, hedge cutting, mangel pulling, and winter feeding out. One man at £4 per week, equals 8 weeks equals £32 plus holiday pay and keep £2, equals - - £34

Wages:

Harvesting Labour:

Stacking barley, owner to find four extra men, one horse and dray for one day: horse and dray 5s.; four men at £1, £4.

Stacking 24 tons lucerne hay, owner to find five extra men for four days at £1 per man per day, £20.

Potatoes dug, sorted, and bagged by hand with help of casual employee employed for two months (May-June).

Total harvestng labour - £24

Contract Work:

Baling 24 tons lucerne at 23s. 3d. per ton, £29; threshing barley, 225 bushels at 8d. bus., £8; total contract - - - £37

Keep for Casual Workers:

One man, eight weeks at £1, plus other £10 - - - £18

Wages of Management:

For a farm of this size it is generally considered that the reward to a working owner with a wife and three young children of school age would be in the vicinity of £325, without allowing for payment of life insurance and Social Security taxes.

Overhead:

Rates, say 1¼d. per £ capital value of £3020, £14; Land Tax, 1d. per £ unimproved value of £1500 less £500 exemption, tax on £1000, £4;

Insurance, employer's lability and

personal risk £4; buildings, value £1045, 8s. 8d. per £100, £5; total insurance - - - £9

Depreciation, wood and iron buildings £1070 at 2½ per cent, £27; implements and plant, £357 at 7½ per cent, £26; total depreciation £53.

Interest: live and dead stock, £797 at 5 per cent, £40; land, 65 aces at £46 10s. per acre equals £3020 at 4½ per cent, £136.

CONCLUSION

Farmers should bear in mind that while this budget is a complete forecast of the management envisaged on a hypothetical Canterbury dairy farm, it is not suggested that the farming policy herein described should be literally followed. It is intended that farmers will be helped in their budgeting by using this as a basis or example.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.

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AGRICULTURAL BULLETIN

Blacksmithing Tools and Methods

Prepared by the Canterbury Agricultural College, Lincoln

Bulletin CHRISTCHURCH, JULY 1945. No. 192

Bulletin No. 181 dealt with carpenters' and engineers' tools suitable for the farm workshop. This Bulletin deals with blacksmiths' tools, and describes briefly some of the methods used in blacksmithing.

BLACKSMITHING

The use of mass produced iron and steel machinery, with interchangeable spare parts, together with the advent of the fabrication of articles using the gas and electric arc welding processes, have reduced the importance of blacksmithing, or forging as it is sometimes called. Nevertheless, a farmer who has a forge and anvil and a few smiths' tools, and knows how to use them, will find that there are many jobs that he can do himself, thus saving expense and valuable time. For this purpose he requiries some or all of the following tools. Many of these tools are available cheaply second-hand.

FORGE (see diagram)

The forge illustrated has a water-cooled "tue iron" (tuyere), the blast being provided by an electric or hand blower or bellows. A good forge of this type can be made from an old 400-gallon galvanised square iron water tank, cut down. Cast iron or steel portable forges are also obtainable.

ANVIL

An anvil weighing about 2cwt is useful for other work besides forging. It should be spiked down to a wooden block so that it can vibrate up or down but not move sideways.

HAMMERS

A good quality ball pane hammer (Fig. 2) weighing about 2lb, and a sledge hammer (Fig. 1) (8lb) are necessary.

TONGS

The most useful shapes are: (a) flat bit tongs (Fig. 3) for holding flat work, but also grooved down the centre for holding small round work; (b) square bit or v-jaw tongs (Fig. 4) for different sizes of round or square work; (c) anvil tongs or pliers (Fig. 5) for picking up hot work; (d) right-angle tongs (Fig 6) for holding rings etc.; (e) round-mouth tongs (Fig. 7) for holding round work vertically for upsetting. The blacksmith's wrought iron leg vice is good, or a 5-inch or 6-inch engineers bench vice, preferably cast steel.

ANVIL CUTTER OR HARDIE (Fig. 11)

This fits in the square hole of the anvil and is used for cutting off bars of iron or steel. It is almost indispensable.

SETTS

The hot sett (Fig. 9) and the cold sett (Fig. 8) are used for cutting off hot and cold bar respectively, the cold sett having a blunter taper to stand up to the heavier work.

PUNCHES AND DRIFTS

It is often quicker to punch a hole in hot metal than to drill a hole, and it doesn't weaken the bar as much. Drifts are used to enlarge a punched hole to the required size. A range of sizes of hot punches, round and square (Figs. 13, 14), and drifts (Fig. 12), are required.

MEASURING TOOLS

The blacksmith's 2-ft brass rule (Fig. 17) and calipers (Fig. 16) are required.

FARRIER'S OR SHOEING TOOLS

The shoeing hammer (Fig. 18), buffer (Fig. 21) for cutting nails before removing shoes, pincers (Fig. 20) for drawing nails and tearing off shoes, paring or shoeing knife (Fig. 22) for dressing the hoof

before fitting shoes, shoeing tongs (Fig. 26) for holding shoes, toe knife (Fig. 27) and rasp (Fig. 23) for cutting off surplus hoof and for bevelling and trimming hoofs respectively, after nailing on the shoes. If the shoes are being forged, a small fuller (Fig. 25) and a square shoeing punch (Fig. 18) for the nail holes are required.

CARE OF TOOLS

Care of tools and careful storage are important. All the metal cutting tools require grinding and sharpening when blunted and forging out when necessary. A piece of bar 2in x ⅜in screwed to the wall, with pieces of ⅜in diameter round bar about four inches long, screwed to it and spaced to suit the tools, makes a very good tool rack.

MATERIALS

To be competent in forge work it is essential to understand the difference in nature between the common types of iron and steel met with in repair and construction of farm implements and what can and cannot be done with them in the way of heating, hammering, and bending, hot or cold.

Wrought iron and mild steel are both very suitable for forging, being readily bent and hammered out when hot. Wrought iron is a very pure form of iron but is rarely obtainable nowadays — mild steel, which is cheaper, replacing it for forge work. Mild steel, which is iron with a small proportion of carbon, is obtainable in the form of flat and round bar, angle iron etc., and used for general forging work such as chains, eye bolts, hooks etc. It is not brittle, can be bent cold and can be readily bent and drawn out when hot. For forging, mild steel should be heated to, but not above, a bright red heat when viewed in shadow.

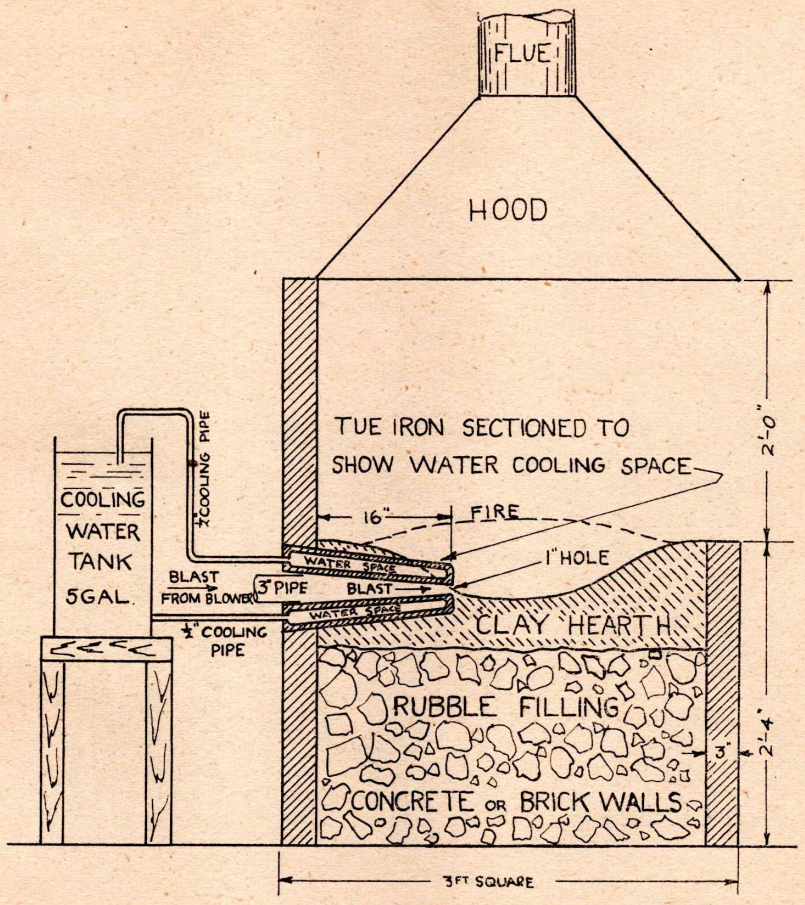
Tool (or cast) steel and spring steel are varieties of high carbon steel. This consists of iron with a higher percentage of carbon than mild steel. It can be forged fairly readily but must not be heated above a cherry red, or the quality of the steel will be impaired. High carbon steel has a very important property in that if it is heated to a cherry red heat and cooled rapidly, e.g. by being plunged in water, it becomes very hard. All cutting and hammering tools are made of tool steel, because of the property of being able to be made very hard, in which it differs from mild steel. Tool steel is frequently supplied in the form of octagonal (eight sided) bars suitable for forging cold chisels, crowbars etc., and in round form for screwdrivers and punches. A similar steel, but with less carbon, really a medium carbon steel, is being used nowadays for agricultural implements, particularly for highly stressed parts such as plough beams and legs, wheel spokes etc.

Cast iron contains a large proportion of carbon and other impurities and thus cannot be bent cold, and is also totally unsuitable for forging. Malleable cast iron is cast iron that has been treated by a special process to remove the carbon and make it malleable, i.e. able to be hammered or bent. Malleable castings can be bent cold to a certain extent, and can also be forged hot, but care has to be taken to avoid overheating, and also cracking when forging hot. Generally speaking, it is not a good material to forge. Examples are, mower fingers and malleable plough shares.

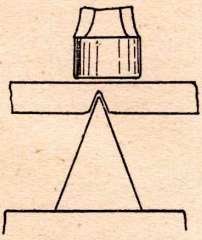
METHODS

It must be clearly understood that blacksmithing is a highly skilled trade, which requires long years of practice to attain a high degree of competence. Nevertheless, perseverance, practice, and application of common sense will enable any person fairly handy with tools to carry out simple forging jobs, provided he has a few good tools. Tuition in blacksmithing, including horseshoeing, is given to nearly all agricultural students at Lincoln College, where nine forges with full equipment are installed in the blacksmith's shop. In the following paragraphs brief hints in carrying out a few simple blacksmithing jobs are given.

Care of fire. A good fire is essential for good forge work. To light the fire, clean out the hearth around the tue iron, removing clinker and ashes, place a handful of shavings or paper around the tuyere opening and light it, blowing gently with the blast. When burning freely, work pieces of coal in around the edges, leaving a small opening in the centre at first; then fill the opening with small pieces of coal, leaving spaces between for the blast. Keep building up until the fire is five or six inches deep. Wetting the coal

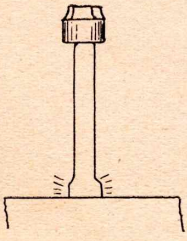


BUILT UP FORGE



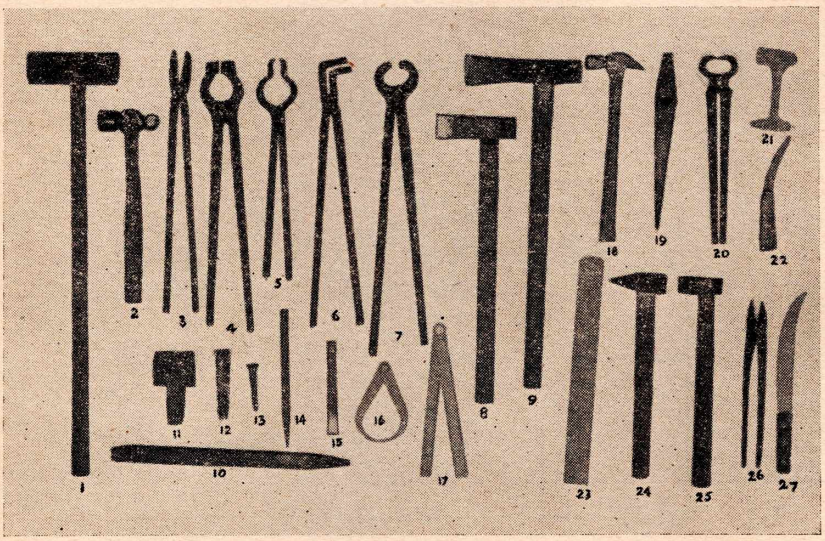
CUTTING OFF
ON HARDIE

DRAWING OUT
ON ANVIL HORN



UPSETTING

UPSET AND SCARFED ENDS
FOR FORGE WELDING.



General Smith's Tools: 1 — Sledge hammer. 2 — Ball pane hammer. 3—Flat bit tongs. 4—Square bit tongs. 5—Anvil tongs or pliers. 6—Right-angle tongs. 7—Round-mouth tongs. 8—Cold sett. 9—Hot sett. 10—Mandril. 11—Hardie. 12—Drift. 13—Round punch. 14—Square punch. 15—Cold chisel. 16—Calipers. 17—Rule.

Farrier's or Shoeing Tools: 18—Shoeing hammer. 19—Shoeing punch or pritchet. 20—Pincers. 21—Buffer. 22—Paring knife. 23—Rasp. 24—Shoeing punch on handle. 25—Fuller. 26—Shoeing tongs. 27—Toe knife.

round the fire improves it. Keep the fire high in the centre, and place the iron or steel to be forged near the top of the fire, where it is hottest. Regulate the blast carefully to suit the work—too strong a blast on thin steel will burn it away rapidly. When the steel burns, sparks appear above the fire; this must be avoided or the steel will be ruined. The fire must be kept clean, ashes and clinker being removed regularly.

Cutting off (see diagram). To cut a piece of bar, heat it in the forge, place across the hardie, and strike the bar with the hammer. Reverse the bar, and hammer from the other side, until nearly cut through. Finish off by projecting the cut over the anvil and striking with the hammer. Another method is to use the hot sett, the smith holding it in position while the striker hits it. The sett should not strike the hard face of the anvil, as the sett will be blunted or the anvil damaged. The small ledge on the anvil next to the horn is useful for cutting off, as its face is not hardened.

Bending. A large portion of the smith's work consists of bending different shapes and sizes of bar. Simple right-angle bends are made over the face of the anvil or in a vice, and circular bends over the beak of the anvil. A good heat is essential and the work should be re-heated if it cools below a red heat before the bend is completed. Do not waste time, but "strike while the iron is hot". This applies to all forge work.

Sometimes it is desired to make a fairly sharp bend at a definite point in a bar. After removal of the bar from the fire the heat can be localised at the desired point by dipping the bar in water so as to cool it either side of the bend, leaving the site of the bend hot.

Drawing out (see diagram). This is the process of lengthening a bar and reducing its cross section by hammering, e.g. forming the point on a bale hook or meat hook. It is done by bringing the work to a good red heat and hammering it out to the desired shape, preferably across the horn of the anvil. Reducing the diameter of a round bar is best done by first drawing it out by hammering it square, and then rounding it up again.

Upsetting (see diagram). Upsetting, sometimes called "staving" or "jumping up", is the reverse of drawing out, the bar being thickened at some desired place. An example is the eye of a shackle, the bar for which has to be increased by about fifty per cent in width and thickness before punching the hole. Upsetting is done by heating the bar to a white heat, and cooling out in water rapidly right up to the part where the upset is required. If the enlargement is required at the end, it is done, if the bar is short, either by resting the cold end on the anvil, with the bar in a vertical position, and hammering the hot end, or vice versa. If the bar is long, it must be held firmly with the hand or tongs over the anvil and the upset hammered. Upsetting can also be done, particularly where it is required near the middle of the bar, by bumping it up and down on the anvil.

Punching. Hot punches can easily be forged out from octagonal tool steel bar, or from old round files. They should be given a slight taper. To punch a hole in a hot bar, hold it over the small round hole in the anvil, and drive a quarter-inch punch through. Repeat with increasing sizes of punch, and finally drive through a "drift", which is a piece of round steel of the diameter of the hole required, and slightly tapered both ways. Square holes can be punched with a square punch. Another method, suitable for large holes, is to split the bar with a cold chisel where the hole is to be, and drive a punch or drift through to enlarge the split into a round hole of correct size.

Tool Forging. Tools such as chisels, screwdrivers, and punches, must be forged out of tool steel. Great care is required in heating and forging this material. It should not be heated above a cherry red heat, as overheating ruins the metal, and it must not be hammered at a much lower temperature than this, or it may crack. To forge a heavy flat cold chisel take a piece of $\frac{3}{4}$-inch octagonal chisel steel, about seven or eight inches long, heat one end, and hammer the bevel on the top. Now heat the other end and draw it out to a point by hammering over the horn of the anvil, finishing on the flat face of the anvil, and allow to cool. The chisel is now too soft to cut and the point must be hardened. This is done by making use of the property of high carbon steel, that

when heated to a red heat and cooled rapidly it becomes hard. The steel will then be too hard and brittle for use as a cutting tool and it must be reduced in hardness by the process of "tempering" or re-heating slightly. The process of hardening and tempering the cutting edge is carried out as follows: The lower one-third of the chisel is heated to a cherry red heat, and about one and a half inches of the tip is dipped into cold water and moved around rapidly to vary the depth slightly. In a few seconds the chisel is removed. The point is now hard, and is tempered by allowing the heat still in the shank to run down to the points to raise the temperature enough to soften it. The temperature is usually judged by the colour of the oxide film which changes as the temperature of the steel is raised. Rapidly polish the point of the chisel with a piece of brick, an old file, or emery paper, until it is bright. A series of coloured bands, straw, followed by brown, then purple, then light blue, and last a dark blue, will be seen moving down towards the point as the heat travels down the chisel. The colours are blended together more or less, the whole range occupying about half an inch. When the straw and brown have passed off the point, and the purple is just about to disappear with a blue beginning to show, plunge the whole chisel in water again, and move it round. This prevents further re-heating. Another approximate method of judging the temperature for tempering is to hold the point of the chisel after quenching against a piece of soft timber. When it begins to smoulder, plunge the chisel into water. The chisel is now tempered and requires grinding on the point to a blunt angle, about 60 degrees. Other tools, such as different shapes of chisels, screwdrivers, punches, can be dealt with similarly, and blunt tools re-pointed. The correct tempering colour for different tools is easily found by trial and error. Some steels crack when quenched in water, and should instead be quenched in oil. The heads of chisels must on no account be hardened. In the case of high carbon steel that has been hardened and which is to be hack sawn or drilled, it can be softened again by heating to a red heat and allowed to cool slowly while buried in ashes.

Case Hardening. Parts made of mild steel that are subject to wear can be case hardened. This gives them a hard-wearing surface. Examples are the heads of set screws, pawls, quadrants and pins of hand levers of ploughs etc. A simple method of case hardening is to heat the part to a cherry red, sprinkle with or plunge into one of the patent case-hardening compounds on the market, and re-heat for a few minutes. Then plunge into water. Repeat if it is desired to make the hardening process penetrate further in.

Forge Welding (see diagram). Sound welds between two pieces of steel can be made by heating each part to a white heat so that the outer surfaces are molten and then hammering them together. The two pieces are thus united into one piece. To get good welds, a good clean fire, free from clinker and ashes, is essential. The temperature must be correct and overheating must be avoided. Practice is needed to judge the correct heat. To weld two pieces of flat bar steel, scarf the ends by upsetting slightly and hammering to a bevel, the face of the bevel being slightly convex. Heat both pieces to a white heat until just about to melt, remove quickly from the fire, strike on the anvil to remove scale etc., working rapidly place them flat on the anvil with bevels in contact, drop the tongs from the right hand, strike a quick blow with the hammer, turn over, and repeat. These first blows stick the ends of the scarf together and then several hard blows are required to complete the weld. Some blacksmiths use borax or sand as a flux, but this is not necessary if the fire is clean. Round bar, such as for chain links, is bevelled off in a similar way before welding.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

SWEET CLOVER

Prepared by the Canterbury Agricultural College, Lincoln

Bulletin CHRISTCHURCH, AUGUST, 1945. No. 193

There is considerable interest in white sweet clover in New Zealand at the present time following the successful utilisation of the crop by the McCaw Bros., of Hakataramea. It was first grown by them as a soil improver and later proved useful as a forage crop for fattening lambs. Their experience has been used in this bulletin with the object of presenting information to those farmers who are interested in the crop.

In America interest in sweet clover commenced about 1910 and since then the clovers have become important soil improvers and forage crops in Northern United States and Canada. In the N.Z. Journal of Agriculture for May, 1915, there is a record of its being grown in Taranaki as a forage crop for dairy cows and in 1920 it was grown in Canterbury under the name of Bokhara clover.

Sweet clover belongs to the genus **Melilotus.** It is a native of the eastern Mediterranean lands and is a legume. There are three species, all of which, since 1870, have been recorded in New Zealand as weeds. The three species are:—

1. White Sweet Clover (Melilotus alba). This is the form which is being grown in New Zealand and is the subject of the bulletin. It is called Bokhara clover and is a biennial, with white flowers. Improved American varieties are Arctic, Madrid White and Alpha.

2. Yellow Sweet Clover (Melilotus altissimus (officinalis). This is another biennal but has yellow flowers. Improved American varieties are: Erector, Madrid Yellow and Aura.

3. King Island Melilot (Melilotus indicus). This is an annual form with yellow flowers. It receives its name from King Island off the coast of Northern Tasmania where it is successfully utilised for cattle fattening. In New Zealand it occasionally develops in coastal pastures and is called yellow lucerne.

DESCRIPTION OF WHITE SWEET CLOVER

The plant is a biennial and when sown in the spring or summer it remains in a leafy form during the first season. In the second season it makes maximum growth and when ungrazed will grow to a height of about three feet when it produces flower heads. It starts flowering in early summer and may grow to six feet or more when in full flower. It flowers profusely on long spikes. At this stage the long stalks become woody and leaves begin to drop. When the seed crop is mature it may grow to 10ft. After seeding the plants die.

In the leafy stage the plants resemble lucerne. They are deep-rooted and can withstand drought conditions as effectively as lucerne. The crop is reasonably hardy and will remain green over the winter if frosts are not too severe. The seed is very similar to lucerne seed, but it is not so long and flat and has a slightly sweet smell. As with many leguminous seeds there is a considerable proportion of "hard seeds" in a sample and scarification is usually necessary before sowing. The seed ripens unevenly and shakes easily, and a certain amount is lost when the crop is cut.

UTILISATION

The crop was originally introduced for green manure, but it can also be used for fattening lambs, for ewes, for dairy cattle and fat cattle, for hay and for seed. Or it can be used for a combination of forage and green manure.

(a) Green manure. Its value for green manure is based on its high

yield and high nitrogen content. When sown in the spring it can be ploughed under in the first autumn, but this is not recommended owing to the difficulty of killing the plants by ploughing at this stage of their growth. The best time for ploughing under is in the spring or summer of the second season. For this purpose the seed can be dropped in the spring on autumn sown wheat, or with spring wheat or barley in the same way as is done with red clover, or the seed may be sown alone. When sown on or with wheat, the clover may grow up with the crop, and even on the lighter soils may, in a wet season, even over-grow it. This would present difficulties in direct heading and the wheat might require to be windrowed or cut with a binder if this condition arises. In most instances, after the wheat is harvested the growth of clover in the stubble may be used for lamb fattening or for autumn and winter feed for ewes. When used in this way the wheat straw is gradually broken down. As previously mentioned it is not advisable to plough the clover in in the first autumn; nor is it advisable to graze the clover too close as this would check it and thus hinder recovery in the spring. There is no need to wait for a tall growth to develop before ploughing under as most of the nitrogen has been accumulated and stored in the roots over the winter. Early ploughing will present fewer difficulties in ploughing under and give just as good results as later ploughing of a more bulky crop. Little difficulty should be experienced in covering a crop up to six feet high by using 8ft. chains, flexible iron rods, or number 8 fencing wire attached to the right side of the skeith axel and fork, or to the cross-beam of each furrow. These tuck themselves under the furrows and drag the crop under, burying everything. As with other green manure crops, seeding of the subsequent crop should be delayed until the material has rotted.

In mixed farming, as practised in New Zealand, improved pastures containing good clovers developed by the use of lime and super provide the fertility building crop in the rotations (Bulletin No. 107 "Soil Fertility"). When heavily stocked and efficiently managed these pastures constitute one of the most practical and economic methods of maintaining or improving soil fertility of cropping land. On wheat farms, blue lupins ploughed under for green manure is playing an important part in maintaining soil fertility. This new crop, white sweet clover, has characteristics which qualify it for consideration either as a green manure crop or for grazings where difficulty is experienced in securing high producing pastures to maintain soil fertility, or as an alternative to blue lupins.

(b) Grazing and hay. It has already been stated that sweet clover is a valuable grazing crop for lambs, ewes and cattle. For this purpose it may be sown in the spring with wheat and grazed in the autumn and spring, or it can be sown in the spring alone, with rape or with a grass mixture. On light, dry land sowing alone is recommended. In the first season care must be taken not to graze too closely but in the second season difficulty will usually be experienced in keeping growth under control. By allowing the crop to re-seed partially each year it is possible to obtain several years' grazing from a stand. In America it is stated that soil improvement following grazing is nearly equal to that following green manuring. As a grazing pasture for dairy cows ordinary precautions must be taken to avoid bloat.

If not allowed to become too mature sweet clover makes good hay but it should not be cut too low, as this may kill the stand. Hay may be taken in the first season, or in the second season. It is chiefly in the second season that stemmy hay is likely to be made. Sweet clover hay which is baled or stacked in poor condition and develops mould, is liable to cause the so-called sweet clover disease. This disease results in the blood losing its clotting power, and animals may die from loss of blood following cuts and wounds. Where mouldy hay is used the disease can be controlled by feeding lucerne hay in equal quantities with the mouldy sweet clover hay.

(c) Seed. Harvesting for seed presents a number of difficulties resulting from the tall growth, the uneven ripening of the seed and the ease with which the mature seed drops off. The crop is too tall and the seed ripens too unevenly to be reliably headed, but direct heading may be possible with short crops.

Tall, heavy crops grow very tangled and this makes windrowing difficult. In addition the headers have difficulty in handling the bulky material. The best method to adopt with tall, dense crops is to cut with a binder when the majority of pods have turned brown, leave the sheaves to dry on the stubble and thresh with a big mill, or stack and thresh.

By "topping" the crop in the spring with a mower when it is about 2ft. high, it is possible to encourage branching, reduce the height of the seed crop and thereby reduce some of the difficulties.

FACTORS FOR SUCCESS

1. Lime. Sweet clover is one of the lime loving legumes. Heavy applications of lime are necessary on acid soils. As a general recommendation, from half to one ton of lime should be applied before sowing. On land that has been limed within three years, heavy applications may be unnecessary, but it is advisable to drill 2cwt. of lime with the seed.

2. Super. Sweet clover is efficient in utilising soil phosphates and on land that has been well supplied with phosphates in recent years it is unnecessary to add additional supplies, but on land that has not been liberally treated it will be advisable to apply 1cwt per acre when sowing.

3. Inoculation. Sweet clover seed must be inoculated. It is equally important as for the successful establishment of lucerne, and the same inoculation material is used.

4. Seed bed preparation and sowing. The seed is small and it is necessary to develop a fine, firm compact seed bed on which the seed can be drilled shallow at the rate of 6 to 10 lbs per acre of scarified seed, or treble the quantity of unhulled seed in early spring. The seed may be mixed with 2cwt. of lime and applied through the manure box, or through rape plates on a drill.

USE FOR BEES

Sweet clover has the reputation in America of being one of the best honey plants for the hive bee. It flowers profusely in mid-summer—usually after white clover. Bees are necessary for a good seed setting and seed growers and beekeepers could co-operate for their mutual benefit.

SOME DISADVANTAGES

Sweet clover disease associated with the feeding of mouldy hay has already been mentioned. It has caused a taint in wheat. This condition arises when sown or volunteer clover grows up in a wheat crop and the green leaves are cut when the wheat is headed. This condition is likely to arise in good seasons or on heavy land when the spring and summer growth of sown or volunteer clover is very good. Dried sweet clover in sheaves or windrow does not cause taint. It has been suggested that it causes a taint in milk and in meat, but the question of milk taint has been disproved and there is no evidence of meat taint in any American literature or from New Zealand experience.

Lastly, owing to the presence of hard seeds, once a seed crop is taken it is likely to persist in the land and appear as volunteer plants in subsequent crops. This may cause difficulties where red clover and lucerne are grown for seed as the two kinds of seed would be very hard to separate in machine dressing.

CONCLUSION

Sweet clover is a leguminous crop which is capable of prolific growth when heavily limed. In America it is used extensively for soil improvement as green manure or as forage, and while it is a relatively new crop in New Zealand, it may find a useful place in our cropping programme. It can be sown in spring on cereal crops, thus helping in the utilisation of headed wheat straw. Alternatively, the straw and green growth may be ploughed under together when the straw will rot more readily than without the clover. It may be sown alone, with rape, or with grass in spring or early summer and used as autumn, winter and spring grazing for sheep or dairy cows. By allowing it to re-seed, permanent grazing can be obtained. It has certain disadvantages but by care these can be minimised. At the present time supplies of seed are very limited and unless importations are made farmers will not be able to secure supplies for some years. The College has no supplies at present, and McCaw Bros. have none for distribution this year.

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ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

Dehorning, and Construction of Cattle Yard, Pen and Crush

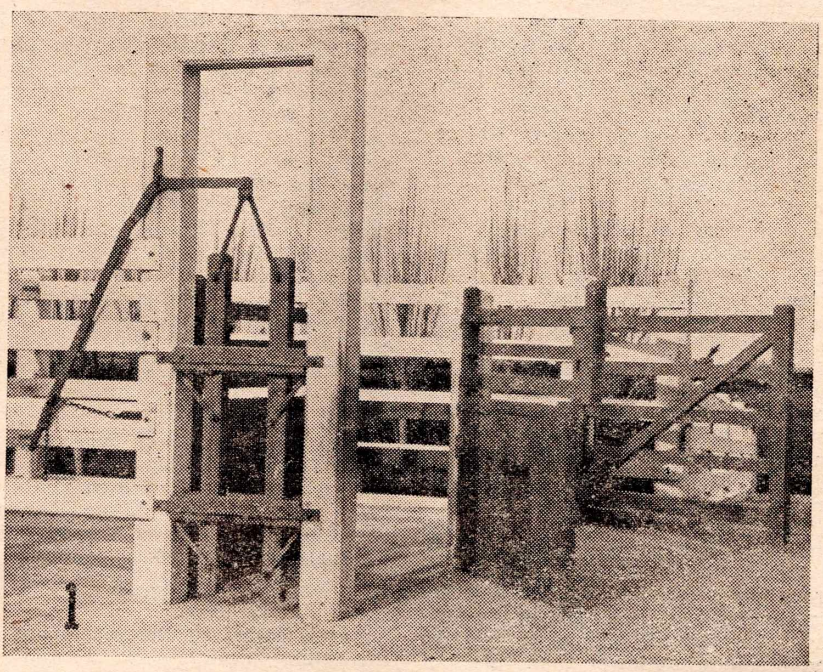
Prepared by the Canterbury Agricultural College, Lincoln

Bulletin. CHRISTCHURCH, SEPTEMBER, 1945. No. 194.

The accompanying drawings and photographs show the cattle yard, pen and crush erected at the dairy at Lincoln College, and also a layout more suitable for handling beef cattle. Full details and dimensions are given in the drawings, while the photographs illustrate the finished work. Considerable variation is possible in the actual layout, to suit a particular site or different construction. For example, timber posts, provided they are sufficiently strong, could be used instead of concrete posts. Again, a concrete floor to the yard and pen, although desirable for drainage and cleaning down, is not essential. A long race from yard to crush, as shown in the photographs, is essential for beef cattle.

The particular layout shown in the drawings was constructed as part of the dairy, and the concrete floor is continuous with the cow-yard floor. Entrance, curbs, fall, etc., can be rearranged to suit any particular site.

Figure 3 is an elevation and plan of the existing layout at Lincoln College. The arrangement shown with the pen inside the yard, while satisfactory for dairy cattle, is unsuitable for handling beef cattle, for which a race lifting gate, and general layout of yards as shown in the photographs, figures 5, 6, and 7 is desirable. Figure 2 shows the



Cattle Crush and Pen at Dairy, Lincoln College.

crush. This is suitable for both beef and dairy cattle, but in addition the provision of a 4" x 2" removable horizontal bar at a suitable height to prevent calves getting their shoulders through the crush would be an improvement.

Figure 4 is a diagram of the double gates of the pen. The triangular gate as shown in figure 7 is an alternative construction favoured by some farmers.

Figure 1 shows a photograph of the finished crush and pen.

Brief instructions are given below on various aspects of construction.

CONCRETING:

Good practice should be followed in mixing and placing the concrete. The mix should be 1 cement, 2 sand, 4 screened gravel or crushed stone. Instructions on concrete work are given in College Bulletin Nos. 23 and 93 and in the Department of Agriculture Bulletin No. 184, or cyclostyled notes on concreting may be obtained on application to Lincoln College.

CONCRETE POSTS:

The concrete posts, which are each reinforced with four half-inch diameter rods, should be cast in place. They are bevelled 1 inch on the corners. The formwork or boxing should be strong, well braced and capable of being easily dismantled and re-erected, and great care must be taken to provide for the subsequent fastening of rails, gate hinges, etc., to the posts. Bolts which are to be cast into the concrete should be fixed in their correct positions in the forms. The holes for the ¾ inch coach bolts that hold the 6 inch x 2 inch rails of the yard to the posts should be made by fastening round pieces of timber a little greater than ¾ inch diameter to the forms in their correct position and greasing them for easy withdrawal. Blocks should be fastened to the forms to leave slots where the 6 inch x 2 inch rails are sunk into the posts.

The posts of the crush to the underside of the cross beam are 8 ft. 6 inches high. At this height the cross beam can be used for hoisting up the head of a horse for drenching. If desired, the posts can be made somewhat lower than this, but the cross beam should be retained for bracing.

CONCRETE FLOOR:

The floor should be at least 4 inches thick, and if the ground is soft it should be dug out and filled up to the correct level with hard filling, such as shingle, before laying the floor. The posts should be cast in place first and then the floor and curb. To avoid cracking, the floor should be laid in sections not more than 6 ft. square. The curb can be cast in one piece with the floor. The floor should have a fall of about 3 inches in the width of the pen, and a gutter provided to take away the water used in washing down. A curved fillet should be provided at the junction of the posts, curb and floor, for ease in washing down. The floor surface should be grooved to prevent slipping.

TIMBER:

The timber should be of jarrah or other Australian hardwood, but if this is unprocurable, well seasoned heart rimu, matai, or beech will be quite suitable.

IRON WORK:

The iron work for the crush is quite simple and can be constructed from stock sizes of mild steel bar. Most of the work can be done with a hacksaw and drilling machine, but if there is no forge available the services of a blacksmith will probably be needed to forge the lever and weld the lugs on the brackets holding the swinging links of the crush, although these brackets can quite easily be cut out of angle iron. The bars should not be made of lighter cross-section than is shown on the drawing, but can be made heavier if the sizes shown are not available.

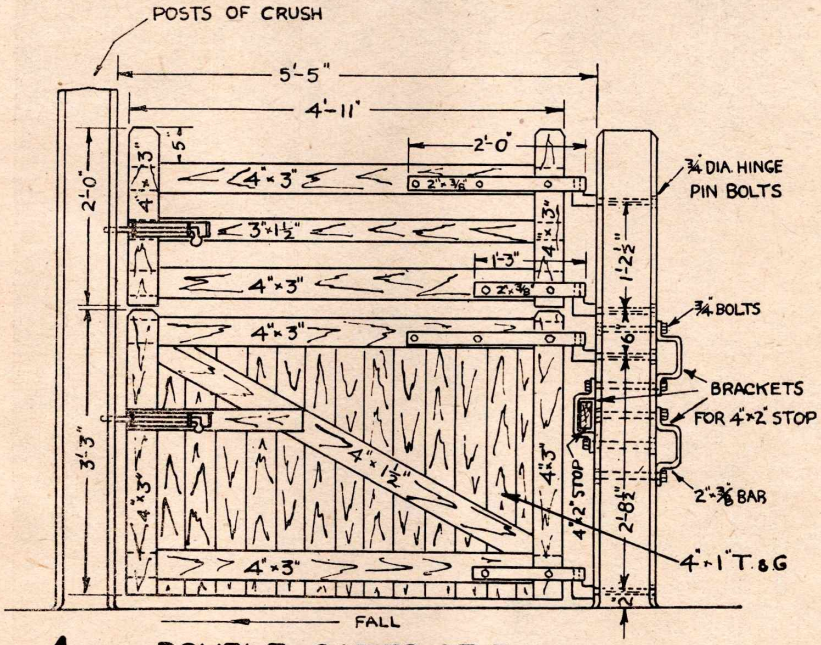
Some blacksmithing work will be required for the hinges, pins, bolts and brackets of the gates and pen, or they could be purchased ready made.

PAINTING:

The timber and iron work should be well primed with red lead and linseed oil, and given two coats of good paint before erection. A coat of white cement gives a good finish to the concrete work.

DRAWINGS:

Large copies of the accompanying drawings, figures 2, 3 and 4, are available on application to Lincoln College.



4 DOUBLE GATES OF PEN

DEHORNING can be carried out by three methods:—

1. From birth to a period of two to three weeks old, before the horn develops, the core of the horn can be removed by applying caustic soda. Cut the hair around the horn core or scurr, then rub in vaseline round the horn core. Then apply caustic, rubbing it vigorously until there is a faint blood tinge on the scurr. See that the calves so treated are not left out in the rain for a day or so. It may be necessary to repeat this treatment in seven to ten days. A stick of caustic can be kept in a tightly corked bottle. It is held between the fingers, with a piece of paper, the other end is moistened with water.

2. From three weeks to three to four months old, a special sharp edged cup-shaped gauge may be used to remove the horns. In using this it is necessary to press down firmly, so that the horn producing skin at the base is removed. Apply Stockholm tar to the wound.

3. From eighteen months upwards, the horns may be roved by means of dehorning shears. The best shear is a single-bladed guillotine which again must be applied so as to remove the horn producing skin, otherwise the horn will continue to grow. Apply Stockholm tar to the wound, and leave the animals quietly in the paddock after the operation, so that bleeding may be reduced to a minimum. Cutting the hair around the base of the horn, prior to the operation, will assist the operator.

The use of a poll bull will obviate dehorning in the first cross.

The yards may be found convenient for handling horses and for speying cows.

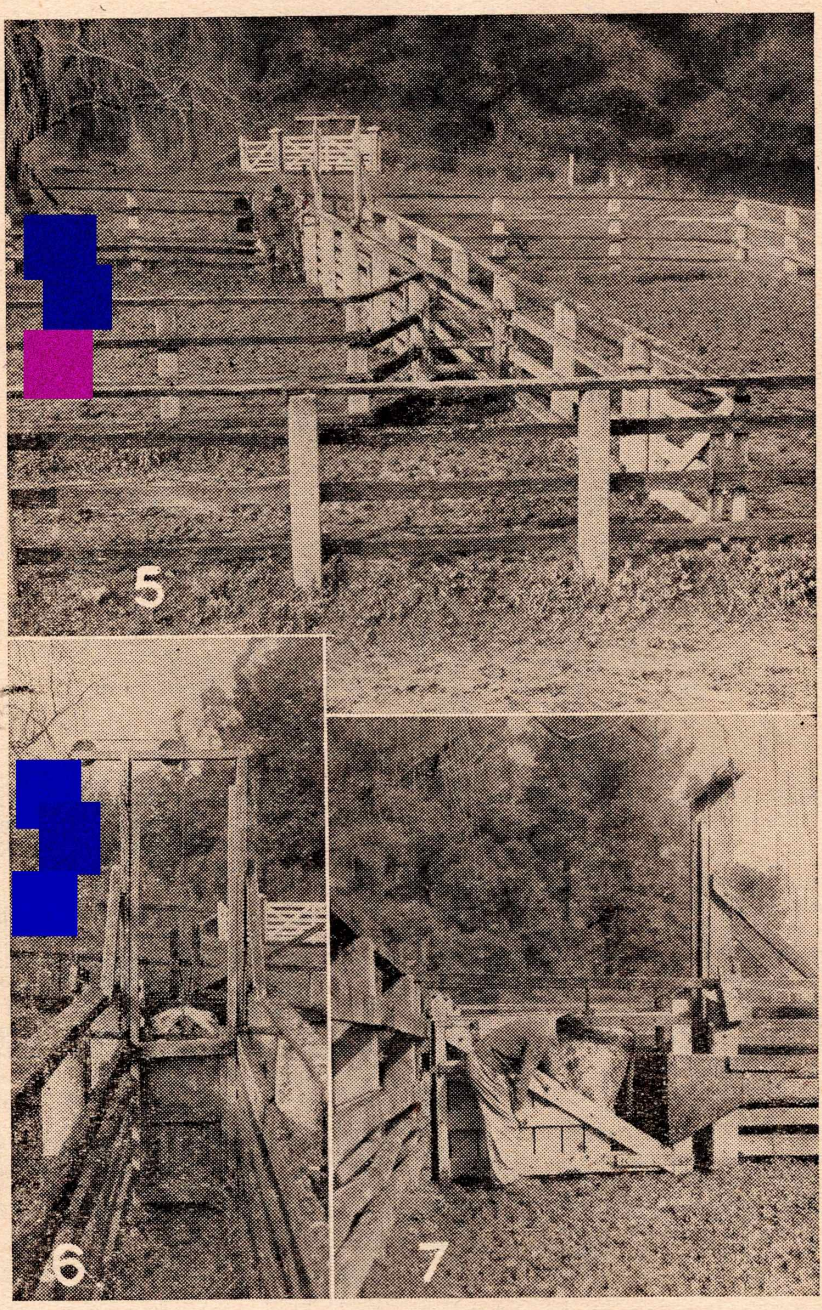
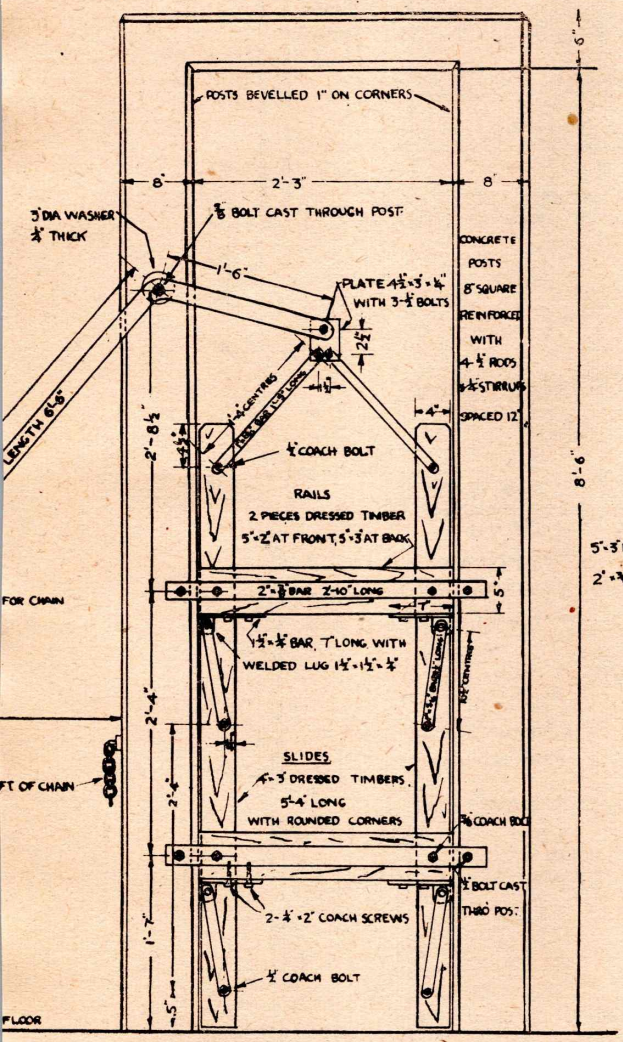


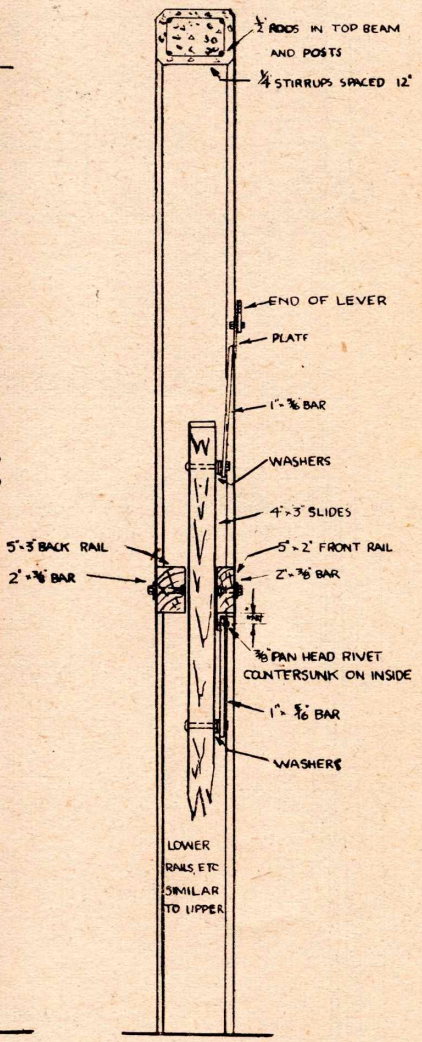
Fig. 5: General view of Yards and Race suitable for beef cattle.

Fig. 6: Rise and Fall Gate at entry to pen.

Fig. 7: Triangular Gate as alternative to Double Gate shown in Fig. 4.



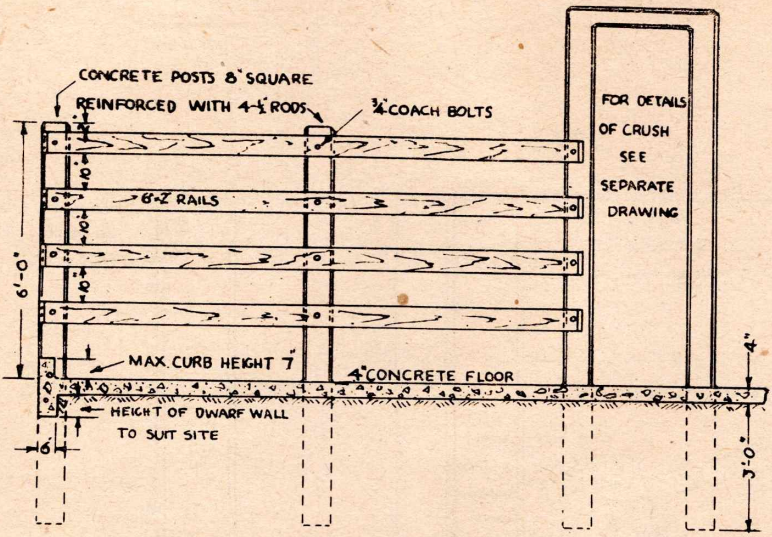
FRONT ELEVATION



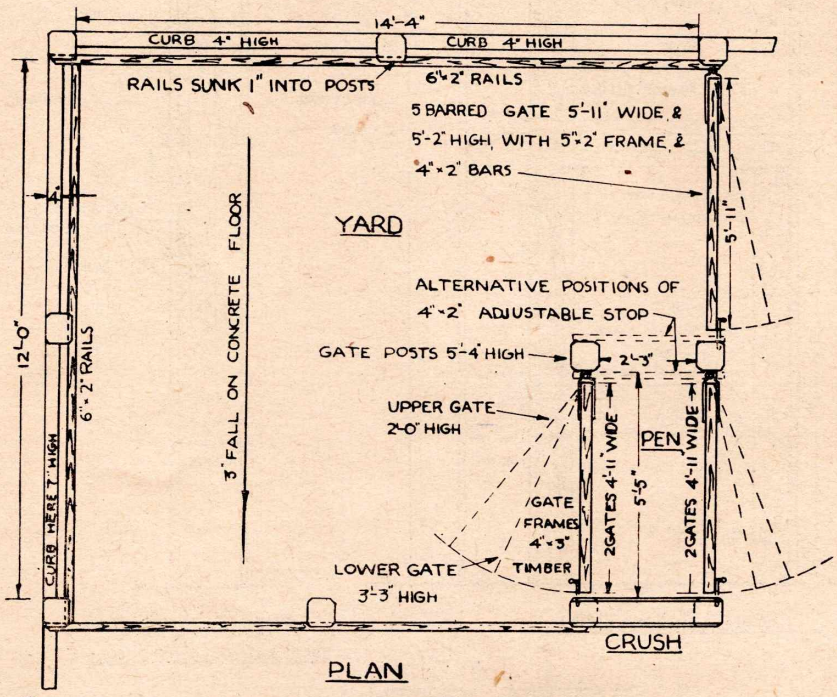
SIDE ELEVATION
SECTIONED ON CENTRE LINE

CATTLE CRUSH

Cattle Crush at Dairy, Lincoln College.



ELEVATION OF FRONT OF YARD



PLAN

3 CATTLE YARD PEN AND CRUSH

Arrangement of Yard, Crush and Pen at Lincoln College. This lay-out without a race leading to the pen is unsuitable for beef cattle.

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CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

LINSEED

Prepared by the Canterbury Agricultural College, Lincoln

Bulletin. CHRISTCHURCH, OCTOBER, 1945. No. 195.

Linseed of excellent quality has been grown in New Zealand for many years. During the war, there has been an acute shortage of linseed oil and a linseed oil industry has been established in Dunedin to ease the position by utilizing surplus seed from the linen flax industry for oil production. During the last two years over 900,000 gallons of oil produced has undoubtedly assisted the manufacturing and painting industry and the country generally. To-day, linseed oil is being used to such an increasing extent in the industry of all countries that New Zealand is expected to have to rely on her own production of linseed to produce her linseed oil requirements. Production from 25,000 acres of linseed is required annually and contracts are being arranged with farmers in an endeavour to secure the full acreage required in the 1945-46 season and in each succeeding year.

In 1930, Bulletin No. 14 of the series entitled "Linseed Growing as a Sideline" was published. Three outlets for the product were discussed: (a) the export of linseed for the world's market; (b) the manufacture of linseed oil in New Zealand with stock food as a by-product; (c) the production of certified seed of fibre types for export to the British Isles and other flaxgrowing countries which could not produce high quality seed so readily as New Zealand. Outlet (b) above now provides a readily available local market for an extended area of a spring sown crop. Outlet (a) may be available should any surplus be produced, and (c) still exists and may provide an outlet.

The development of the linen flax industry in New Zealand during the war period has resulted in a valuable emergency contribution to the United Nations' fibre resources, but a reduction in the profitability of the fibre market can be expected when European supplies are again available.

As a cash crop, linseed can be grown on many of the cropping areas of New Zealand, as an alternative crop to spring wheat, spring oats, barley and peas. It is usually sown in spring or early summer and on most soils it can be sown later than other crops. In some localities on medium dry soils autumn sowing may be tried as an experiment. It can be underseeded with pasture grasses and clover, or cocksfoot for seed production. The present contract price is £27/10/- per ton for farm-dressed F.A.Q. seed, free on rail, sacks extra. Harvesting costs may be kept to a minimum by windrowing or direct heading. With a guaranteed price and a guaranteed market the crop is a relatively safe one. High yields of good quality seed can be obtained on a wide range of soil types and under varying conditions, provided good husbandry is practised.

SOILS.

The crop has a short growing season and makes most growth during the early summer. In districts where this period is normally dry the "Bison" variety of linseed may prove more satisfactory than varieties previously grown. Linseed is commonly grown as a late spring sown crop on the heavy wet soils near the mouths of the Canterbury rivers and also on the clay soils in the foothills districts where summer droughts are infrequent and where wheat-growing is unreliable.

PLACE IN ROTATION.

The soil should be in a high state of fertility and free from weeds. The best method of building up soil fertility on cropping areas is

through the establishment of vigorous pastures with adequate clovers encouraged by heaving liming and annual application of phosphate. After several years' grazing the fertility of such land is at a high level as a result of the accumulation of dung and urine from animals as well as of organic matter from plant residues including dead roots, leaves and straw. When in this state of fertility it should produce good crops of cereals or linseed.

Linseed can be sown to advantage after such a pasture ploughed in the early winter. By early ploughing, time is given for complete rotting of the turf and breaking down the soil to make continuous contact with the subsoil and to develop that firm compact seed bed so necessary for all small seeds. It is well known that the first crop after grass is generally the cleanest crop in the rotation. This is an additional advantage of growing linseed as the first crop after pasture, as linseed does not compete at all favourably with spring weeds and unless the land is clean weed competition can cause considerable trouble in harvesting as well as reduced yields of seed. Experiments have been successfully carried out in the past in the use of sprays to combat fathen and these experiments are being continued on a larger scale this season. Where weeds are not very troublesome linseed can follow turnips conveniently. This practice was not recommended for linen flax because the irregularity in the fibre quality resulting from urine patches from the turnip field was responsible for low grade fibre. The same objection does not hold for a seed crop and provided the cultivation is started as early as possible and a firm compact seed bed developed, a good crop can be obtained after turnips.

Linseed may also follow any of the autumn harvested cereals or peas, or winter harvested crops of mangels and potatoes, and, provided the land is in a high state of fertility and the cultivation is carefully and thoroughly done, a good crop can be grown.

CULTIVATION AND SOWING.

The seed is small and therefore requires a firm, fine compact seed bed. The crop grows through the dry period of the year so that adequate supplies of moisture in the soil must be assured. These conditions can be provided by early ploughing (May—after grass or stubble; August—after turnips). All deep work should be completed six weeks before sowing and the last four to six weeks devoted to surface work designed to consolidate the seed bed, destroy weeds and weed seedlings and conserve moisture.

The seed is usually sown in September or early October. On strong land it can be sown in early December and on medium dry land it may perhaps be sown as an experiment in the autumn. The seed is drilled shallow on a rolled surface at the rate of about 40lbs per acre, according to the size of the seed. All seed is treated with mercurial dust prior to distribution for contract sowing as a protection against disease. One hundredweight of phosphate should be drilled with the seed.

The importance of care in harvesting and threshing in order to have good seed for sowing is shown by the following experimental results obtained by the Agronomy Division using hand harvested seed which was completely free from injury as against mill threshed seed.

In the incubator the results were as follows:—

Days in Incubator	Hand Harvested Germination
2	100%
3	—
10	—

Days in Incubator	Mill Threshed % Germination
2	67
3	84
10	84

In the glass house similar results were obtained.

Days	Hand Harvested Dusted	Not Dusted
6	98%	99%
13	100%	100%

Days	Mill Threshed Dusted	Not Dusted
6	66%	63%
13	76%	68%

Under the cold conditions of the normal soil in the open the results illustrated strikingly the value of sowing undamaged dusted seed.

Days	Hand Harvested Dusted	Not Dusted
17	92	65
24	98	55
27	98	49

Days	Mill Threshed Dusted	Not Dusted
17	58	36
24	66	39
27	67	39

HARVESTING.

The crop is ready to harvest by direct heading when the bolls have turned straw-brown and dry, when the seeds rattle loosely in the bolls and when the seeds themselves have turned brown and are quite firm. Some loss of seed from shaking may occur when the crop is direct headed, but if the header is ready to start immediately the crop is ready the loss of seed is likely to be small. This is the best and cheapest method of harvesting even and weed-free crops. When green weeds are present, or when the crop ripens unevenly, then windrowing with the mower or the binder is better than direct heading. The crop can of course be harvested with a binder, stooked and threshed from the stook, or stacked and threshed from the stack. If the crop is to be harvested with a binder or to be windrowed, it may be cut before most of the bolls have lost their green colour. A plain sharp knife is an advantage when cutting. Threshing by header or mill presents few difficulties but care must be taken to avoid breaking the seed. The broken seed is liable to mite attack whereas uninjured seed is immune. Reference to Bulletin No. 185 on threshing small seeds will be helpful in regard to harvesting linseed though this crop is not specifically mentioned.

VARIETIES.

The New Zealand commercial linseed and Bull Moose varieties are rapidly being replaced with pure lines of the "Bison" variety, which yields well and is resistant to wilt. Several other new varieties are also being tried and are being grown on contract. All these seed producing varieties are much shorter and more branched than the fibre producing variety. The flowers and seeds are larger and the yield of seed is higher.

The Agronomy Division of the Plant Research Bureau has for some years been engaged in breeding work, with the object of producing varieties that will give high yields of good quality seed and that are immune to "rust," a disease that causes heavy loss in some seasons. Some of this material shows great promise, but it will be some time yet before it is distributed to farmers, because it requires further testing, and then seed stocks will have to be built up.

CONCLUSION.

With higher per acre yields, a guaranteed price and a guaranteed market in New Zealand, the growing of linseed as a spring crop on suitable land is likely to be profitable.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.

ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

WOOL CLASSING

Prepared by the Canterbury Agricultural College, Lincoln

Bulletin CHRISTCHURCH, NOVEMBER, 1945. No. 196.

In former agricultural bulletins: "Wool—Its Use in Manufacture," No. 167, "Utilisation of New Zealand Wools," No. 177, and "Fundamentals of Wool Classing," No. 183—mention has been made of the particular characteristics of the World's Wool Trade—a trade in which a great degree of specialisation exists, and where a great many diverse fabrics are produced from wools varying in fineness, length, colour and other characteristics. The effect of this specialisation of manufacture is evident to the grower when it is realised that in order to sell advantageously at current values, wool must be attractively prepared and must be divided into lines or lots to suit various branches of the trade. It must also be divided so that within any line the wool is of comparable value, or in other words, lines should be even for fineness, length, colour and condition. By doing this, the chance element is removed from the buyer's estimation and proper value is comparatively easily arrived at.

Wool classing deals with the allocation of the whole fleece—as distinct from wool sorting where the staple is the unit and the sorter automatically groups numbers of staples into a particular sort or matching. The classer must not attempt to sort, for this would achieve no useful purpose. Absolute evenness of length and fineness in any one fleece is practically unattainable and although the specialised nature of the industry has been pointed out, in general there is no particular manufacturing concern so specialised that it cannot use wool varying slightly in fineness and length from what it sets out to buy. Furthermore, most of the manufacturing concerns like to sort their own wool, or else they ask for it to be sorted to definite specifications. Beyond the usual skirting, a fleece should not be broken up unless by doing so, the major portion of the fleece can be allotted to a higher grade. A very liberal skirting off of hairy britch wool or sandy back wool sometimes considerably improves the average grade of the fleece.

OVERCLASSING:

There is a definite limit to the number of lines that can be classed out of any clip **on the farm.** In New Zealand, where the average size of clip is about 20 bales, classing on the farm cannot meet the requirements of the buyer who is seeking to fill orders for straight count and type lines. These, in general, are only possible in large clips and in brokers' "binned" lines. Again, if an attempt is made to class out a lot of lines with very little difference between them, then the classer is setting himself a hard task for no particular gain. Small alterations in his standards will occur and where too many lines are being classed out, overlapping becomes serious. When shown for appraisal, the lines within a clip must appear obviously different, one from the other. If this is not the case, then the suspicion that the classing has not been all that it could be immediately arises. This suspicion results in several lines being appraised at the same value and the seller gets the false impression that classing does not pay.

STRIKING LINES:

The success of the whole classing operation depends a lot on the establishment of lines at the beginning of shearing. One has to form an estimate right at the beginning of how much of any particular type of wool one is likely to encounter. If a strange clip is being handled, then any information about previous clips and about feed conditions during the current year

is of value. Possibly up to 200 fleeces will be required before a proper classing plan can be worked out.

SUGGESTED LINES:

It must be made quite clear at this stage that the following classing plans are only an outline and would not necessarily be suitable for many clips. All clips are different in style and evenness and while the outlines set down hereunder follow the fundamental principles of classing, the classer must keep in touch with market conditions and by following new trends can make many payable modifications.

Many different forms of nomenclature exist for a line or lots of wool; actually it is immaterial what a line is called, so long as there is not direct misrepresentation. In general, top lines should be given marking suggestive of top grade wool and for this reason, in this bulletin, the most valuable line has been termed AAA, the next valuable AA and so on.

Merino: Medium sized clip (50-70 bales) ewes or wethers.

1. AAA Merino Combing: 60/70's count. Sound: and bright; good length and style.
2. AA Merino Combing: 60/70's count, Sound; good length; dull and unattractive.
3. A Merino: 60/70's count; short wool and tender.
4. AA ¼Bred Combing: 58/60's count. Bright, sound wool; ¼bred or comeback type.
5. B. Merino: Dingy; only the very worst wool.
6. Merino Broken: Similar to fleece wool and may contain very heavy conditioned fleeces unsuitable for AA and A grades.
7. Merino 1st Pieces: Dull wool, but line does not contain fatty ends or stained wool.
8. Merino Pieces: Short, fatty pieces.
9. Stained Pieces: Heavily stained wool.
10. Merino Bellies.
11. Merino Locks.

If the clip is a very good one, then we may add an AAA Super Combing, 64/70's count. This line would be super grade wool and would have the effect of confining the AAA Combing line to 60/64's count. The B line could probably be dispensed with in such a clip. Some clips may not produce enough good wool to form an AAA Combing line, in which case the AA Combing would hold the best wool; in a clip of this sort, there would probably be a lot of very short wool and it would probably pay to divide the A Combing line, making a separate line of the short wool as distinct from broken and tender. This line would be called Merino Clothing. The lines of fleece for such a clip would then be:—

AA Merino Combing: 60/70's count. Sound; good length; dull and unattractive.

A. Merino: Tender and broken wool.

Merino Clothing: Short wool of reasonably good colour and style.

AA ½Bred: Sound; good length; ¼bred and Comeback type.

B. Merino: Dingy.

It has probably been noticed that not much attention has been paid to fineness. This is because length, style and yield (the weight of clean wool per 100lbs of greasy wool) are all of more importance than fineness in valuing Merino wool.

Considering the lines of oddments, no mention has been made of a separate line of necks. Although they are not so important with Merinos, they usually contain vegetable matter of some kind and in most cases, it is better to keep them as a separate line.

Corriedale or ½Bred. Medium sized clip (50-70 bales) ewes or wethers. Yield is not so variable and length of staple is usually adequate in clips of this kind, so that more attention is paid to fineness. A major subdivision is still made for style.

Suggested lines:

AAA ½Bred or Corriedale: 56/58's count. Sound; bright and good length.

AA ½Bred or Corriedale: 50/54's count. Sound; bright and good length.

A ½Bred or Corriedale: 56/58's count. Short, dull and tender; may include best very slightly cotted fleeces.

B ½Bred or Corriedale: 50/54's count. Short, dull and tender; may include best very slightly cotted fleeces.

½Bred or Corriedale: Dingy or earthy.

½Bred or Corriedale Cotted.

½Bred or Corriedale Necks.

½Bred or Corriedale 1st Pieces: Bulky and good colour.

½Bred or Corriedale Pieces: Short and stained.

½Bred or Corriedale Bellies.

½Bred or Corriedale Locks.

Some clips may have sufficient wool of ¼bred type 58/60's in count and in this case it would constitute

a separate line classed out mainly on a type basis. A flock such as this would probably contain little wool of 50/54's quality.

A small, low-grade clip may be accommodated by making only one line of top grade wool. Conversely, in a good clip, only one line of short and dull wool may be made. In either case, if only one line is made, then set it out to accommodate the two most frequently occurring count groups. Odd very coarse, or very fine fleeces which do not match the line should be kept out and sent to be binned.

A clip in which a lot of dingy and cotted wools occur may be divided up into the following lines:—

A ½Bred: 56/58's count. Short, dull, tender, or showing a break.

B ½Bred: 50/54's count. Short, dull, tender or showing a break.

Fine ½Bred: 56/58's count. Dingy, low yielding fleeces.

Strong ½Bred: 50/54's count. Dingy, low yielding fleeces.

½Bred: Medium cotted.

½Bred Cotted: Hard cotted.

It is assumed that there is not enough good wool for a line and this wool is better binned then put into the A or B lines where its extra value is largely wasted. Note that the degree of cotting has been considered to be of more importance than fineness. This is because all cotted wool has to be opened up by machines before it becomes suitable for manufacture and the hardness of the cott governs the expense and efficiency of the operation.

Romney and Medium to Coarse Crossbred: Medium sized clip (50-70 bales), ewes or wethers.

It is not usual in New Zealand to offer wool as being from a specific breed. The term "Crossbred" is usually used in New Zealand to designate wool from sheep of the Romney, Leicester, Lincoln breeds and the various crosses within these breeds.

Suggested lines for a crossbred clip: —

AAA XBred: 48/50's count. Sound; well-grown; good colour and style.

AA XBred: 46's count. Sound; well-grown; good colour and style.

A XBred: 40/44's count. Lustre wools. Sound; well-grown, but slightly dull and very slightly cotted.

B XBred: 46/50's count. Wool showing a break or tender. Dull and may contain very best slightly cotted fleeces.

C XBred: 40/44's count. Wool showing a break or tender. Dull and may contain very best slightly cotted fleeces.

XBred: Medium cotted.

XBred Cotted: Hard cotted.

XBred Necks.

XBred 1st Pieces: Bulky and good colour.

XBred 2nd Pieces: Short and stained.

XBred Bellies.

XBred Locks.

Often in a Romney clip there is not much wool of 44's count and lower, and unless there is a large amount of wool, only two lines of top grade wool are usually necessary. The counts of these two lines being: average 48's for the finer line and 46's for the coarser line; fairly strict attention being paid to type.

A relatively small average grade clip could be classed into perhaps three main fleece lines, wool not suitable for any of these lines being sent for binning. These three lines would be:—

AA XBred: Average 46's count. Best and brightest wool.

B XBred: 46/50's count. Inferior and showing a break.

C XBred: 40/44's count. Inferior and showing a break.

Bin 1. All good fleeces. 50's count and finer, with short blocky appearance and good fleeces 44's count and coarser.

2. Cotted and dingy wool.

For a large, comparatively poor-grade clip, the following lines are suggested:—

AA XBred: Average 46's count. Bright, well-grown wool.

B XBred: 46/50's count. Wool showing a break and tender. Dull and may contain very best slightly cotted fleeces.

C XBred: 40/44's count. Wool showing a break and tender. Dull and may contain very best slightly cotted fleeces.

XBred: Medium cotted.

XBred Cotted: Hard cotted.

XBred Dingy: Log stained or sandy and earthy.

If there is a lot of dingy wool, then it may pay to make two lines—a fine and a coarse crossbred dingy.

Other Sections of the Clip: Ewe and wether wool comprise the greatest proportion of any clip and there are seldom large enough numbers of Hoggets, Rams or Lambs shorn to give the classer much scope. Moreover, the variability in grade is seldom great, so the necessity for many lines does not arise.

HOGGET WOOL:

Usually three lines are sufficient, although often there is only sufficient wool to make two. When three lines are possible, in a high-grade clip, divide the best wool into two lines according to fineness and length of staple. The inferior wool can probably be left as one line, variation in fineness being largely neglected.

A comparatively poor-grade clip is treated in the opposite manner, one line of good wool and two lines of the poorer wool being classed out. Suggested lines for a clip of 800-1000 Romney hoggets:—

AAA XBred Hogget: 50's count. Sound; good colour and style.

AA XBred Hogget: 46/48's count. Sound; good colour and style.

A XBred Hogget: 46/50's count. Tender and showing a break; colour and style inferior to above lines.

Corriedale and ½bred hogget wool is divided in the same manner, the counts of the best two lines being: AAA 56/58's and AA 54/56's. If only one line of good wool is made, set it out to take the two most frequently occurring count groups and any fleeces which do not fit in should be binned.

LAMBS WOOL:

Lambs usually yield only about 2½lbs of wool so that in most flocks, two lines are sufficient and often only one line is large enough to be sold alone. In the preparation of lambs wool, much can be done on the shearing board by the judicious use of a straw broom. As the belly and crutch of the lamb are shorn, this wool should be swept away, thus leaving the main fleece wool comparatively free of short off-colour wool.

A large clip of XBred lambs can be divided into the following lines:—

AAA XBred lambs: 48/50's count. Short; fine; good colour.

AA XBred lambs: 44/46's count. Longer in staple; good colour.

A XBred lambs: 44/50's count. Belly wool and off-colour fleece wool.

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CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

Disease in Turnips and Related Crops

Prepared by the Canterbury Agricultural College, Lincoln

Bulletin CHRISTCHURCH, DECEMBER, 1945. No. 197

This Bulletin aims to offer an account of what farmers should know regarding diseases, other than those caused by insects, which affect production of turnips and swedes, rape, chou moellier, cabbage and cauliflower.

DRY-ROT:

The disease, caused by a fungus **Phoma lingam,** may result in severe losses among swedes. Effects are less severe on turnips, cabbage, chou moellier, rape and kale. It has been shown that the organism persists under the coat of seed harvested from diseased crops and that infection passes from seed to seedling leaves. When plants are in full leaf small brownish-grey spots appear, these containing spores which pass down to stems or bulbs where round areas of dead tissue develop. If stem infection occurs early, death of the plant results but infection after bulbs are well formed is characterised by cankering about the neck, often followed by a destructive soft rot. Soft decay is a secondary infection by soil bacteria which enter the dry-rot cankers. In a damp season complete crop losses may develop but it is important to note that in the absence of the dry-rot which is a preventable disease the secondary soft rot would be of much less concern. Insects also assist the spread of both types of infection. The grower should apply the following preventive measures:

1. If dry-rot and soft decay are severe do not use the area within two years for swedes, turnips or cabbage. Avoid feeding material on fields intended for these susceptible crops within two years.

2. Endeavour to secure disease-free seed. When our seed supplies were entirely imported a proportion of the introduced varieties carried some seed infection. During the war period it became necessary for the Department of Agriculture to organise swede and turnip seed production from local material and in many respects this was a fortunate development. Healthy crops have been carefully selected for seed purposes in Otago and Southland and it has been shown that New Zealand produced seed compares favourably with imported seed regarding dry-rot infection.

3. New Zealand produced seeds have been classified in the following manner by the Seed Certification Officer in relation to varieties previously imported:—

New Zealand Type	Varieties Represented
1. White Turnips.	
N.Z. Green Globe	Hardy Green Globe, Imperial Green Globe.
N.Z. Red Globe	Lincolnshire Red, Red Paragon.
N.Z. Purple Globe	Purple Top Mammoth.
2. Yellow Turnips.	
N.Z. Greentop Yellow	Greentop Yellow Aberdeen, Greentop Scotch, Fosterton Hybrid, Dale's Hybrid.
N.Z. Purpletop Yellow	Purple Top Yellow Aberdeen, Purple Top Scotch, Waites Eclipse.
N.Z. Green Resistant	Wallace.
N.Z. Purple Resistant	Bruce, Wonowon.

3. **Swedes.**

N.Z. Superlative	Superlative, Masterpiece, Success.
N.Z. Grandmaster	Grandmaster, Majestic, Tipperary.
N.Z. Crimson King	Crimson King, Elephant, Monarch.
N.Z. Resistant	Wilhelmsburger, Otofte, Green Top.
N.Z. Sensation	Vilmorin, Sensation.

4 Any line of seed of good germination capacity can be made disease-free by the hot steep treatment. The treatment is not easy for farmers to apply but the College has facilities for enabling treatments to be carried out for any grower.

The seed lots are immersed in tap water for 15 minutes followed by transfer to hot water at 122°F. maintained for 30 minutes, after which the seed is dried.

CLUB-ROOT.

This disease, with a wider host range than dry-rot, still occurs in severe form in some districts. The casual organism **Plasmodiophora brassicae** differs from the dry-rot fungus in the ability of the former to persist for long periods in soil. Infection develops from soil, not usually from seed, and in early stages seedlings may wilt and die when the fungus penetrates seedling roots. On older plants the infection of roots stimulates plant cell formation leading to characteristic malformations. Later these "club-roots" may rupture providing bacteria with points of entry and consequent soft decay.

Among other features, it is to be noted that weeds included in the Crucifer family such as hedge mustard, shepherd's purse, the cresses, act as carriers. The disease becomes well established on acid soils, where drainage is poor and the water holding capacity high.

Club-root spores are carried in soil adhering to dray wheels, implements, feet of animals and men. They pass unimpaired through animals which feed on diseased roots, thus an infected crop must not be fed out on fields intended within five years for club-root susceptible crops. Where the disease is known to exist, choice of cropping area is important and a susceptible crop should preferably be sown after grass or on an area one year removed from grass. It is advisable to sow swedes, cabbages, chou moellier, etc., on a field in good heart. Provided no serious climatic check to growth occurs, a fast growing crop on good soil is able to withstand severe attacks. If soil is acid, heavy lime applications are required, from 2-4 tons per acre of carbonate of lime, or ½-2 tons per acre of burnt or hydrated lime. Under garden conditions 1 lb hydrated lime per square yard is recommended. Heavy applications at sowing or planting are ineffective. The lime must be applied three months before sowing and well worked into the soil.

This requirement serves to illustrate how necessary it is in preventing disease to plan sufficiently early to ensure that proven preventive measures can be put into practice.

Few crop diseases can be controlled once they become severe but early attention to preventive measures is helpful—in the case of club-root—choice of a field of high fertility with supplementary early liming where necessary. In club-root districts such as Southland choice of variety is particularly important. New Zealand Resistant swede derived from the Wilhelmsburger variety is recommended. Of the turnips, N.Z. Green Resistant (Wallace) and N.Z. Purple Resistant (Bruce) are rarely affected.

Choice of area and liming are of equal concern to market gardeners producing cabbage and cauliflower. Where the disease has been prevalent, seedlings for transplanting must be raised free from initial infection. Seedling box or bed soil should be chemically sterilised using mercuric chloride solution at the rate of 2 gallons per square yard of soil applied 10 days before seeding. The disinfectant should be prepared in a non-metallic container using 1 lb mercuric chloride in 1 gallon concentrated hydrochloric acid. For use add 2 pints of this stock solution to 25 gallons of water in a barrel.

BROWN-OR MOTTLED-HEART.

This disease seems to be increasing in prevalence as is usually the case where "deficiency diseases" develop under continuous crop production. Affected swedes and turnips show no striking outward evidence of disease but when bulbs are cut across, irregular areas of brown woody tissue may be seen grouped about the centre. Among the leafy Crucifers, cauliflowers

seem particularly susceptible, showing an internal stem cracking and browning. Affected cauliflowers remain stunted, producing small curds with areas of brown discoloration. Brown hearted swedes and turnips will not store well but if used before they begin to decay, stock consume them readily. Analyses show, however that diseased roots are appreciably poorer in stock food value.

The disease is physiological in nature, meaning that it is associated with a breakdown in cell development, in this instance initiated by deficiency of the minor element, boron.

Prevention is sometimes complicated by the fact that ability of plants to obtain boron from soil may be reduced by alkaline conditions. Thus heavy liming may prevent club-root and encourage brown-heart. But it has been shown that applications of boron in the form of borax or boracic acid prevent brown-heart. Seed germination injury is likely if borax is in direct contact with seed and Department of Agriculture trials have established the value of broadcasting the borax before or shortly after sowing. 40 lb per acre are required, costing about 30/- per acre. Borated phosphate is less effective than straight applications of borax although the latter, up to 40 lb per acre, can be mixed and broadcast with fertiliser. Should heavy rain fall soon after, the good effects of the treatment will be reduced. Seeding of turnips and swedes should be not less than 1¼ pounds per acre where borax is being used and as with club-root, the N.Z. Resistant variety types are less susceptible to the disease.

BACTERIAL DISEASES:

Soft-rot of swedes has been considered as a secondary infection associated with dry-rot disease. Chou moellier and kale in wet seasons may be affected by black-rot. Leaves prematurely turn yellow and wilt. Black decay areas may be seen on the outer lower stem which on being cut across, reveals inner woody tissue also discoloured black.

Several soil bacteria are responsible for these forms of soft decay but generally they enter through surface injuries. Inter-cultivation after plants are well established contributes to soft-rot infections. Insects also carry infection from plant to plant. Seed is also known to carry these infections, especially when harvested from affected crops. In cases of doubt regarding freedom from bacterial disease the treatment used in combating dry-rot in seed is effective. A mercuric chloride disinfection is particularly suitable for chou moellier, kale and cabbage seed. Half-bag lots of seed should be soaked 30 minutes in the 1 : 1000 solution obtainable by dissolving 10 grams of mercuric chloride in 25 cc concentrated hydrochloric acid. Add this to 2 gallons water for use. After treatment rinse in clean running water and dry.

VIRUS DISEASE:

These diseases among species of some plant families are very serious. A plant virus is not an organism like bacteria and fungi and although the nature of viruses remains a subject of research study, evidence shows that virus diseases are characterised by unusual plant cell accumulations of protein matter. Turnip-mosaic in New Zealand, illustrates the features of a typical virus disease. It produces in foliage a light and dark green mottling. Older leaves are blistered and plants become reduced in size. Viruses have a wide host range. Turnip-mosaic carriers, for example, include most members of the cabbage group of plants, including weeds, as well as garden plants such as stock and wallflower. Many viruses are carried from plant to plant by insects. Few are seed carried and prevention depends on the practicability of eliminating carriers and choice of disease-free parent material. A notable example of the success which can be achieved in checking virus spread among plants vegetatively propagated is to be seen in the Department of Agriculture's certification scheme for potatoes. On the other hand, turnip-mosaic, whether in swedes, cabbages or rape, represents a type of virus against which no practicable field control has been developed.

Crop disease problems are becoming more complex and diverse. Farmers and gardeners who seek advice regarding prevention should send specimen material and information regarding outbreaks to the Plant Diseases Division, Auckland, or Lincoln College.

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CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

The Role of "Environment" In Wool Production

Prepared by the Canterbury Agricultural College, Lincoln

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In discussing wool problems with sheep breeders, it is a common experience to be told in rather a joking tone that "half the breeding goes down the throat." Very few of those who make this statement realise how greatly it understates the effects of nutrition on the production of farm animals. Careful scientific studies have now established that breeding and pedigree nearly always play a **much less** significant role than the half and half estimate suggests. This, by the way, does not mean that the work of breeders is unnecessary or unimportant; it **does mean,** however, that just anyone cannot be a successful breeder and it explains why many self-styled breeders have contributed so little to the standard of the breed in which they work. Where hereditary effects are small, the "common sense" practice of mating best to best in the hope of perpetuating superiority, leads only to disappointment. Special methods of breeding, such as the use of the progeny test, selection on family performance and careful treatment of lines of blood are essential for nearly all the features which directly affect the productive capacity of our livestock.

Although the present bulletin will not deal with breeding, and breeding methods, it may not be out of place to mention how the scientist arrives at relatively exact estimates of the relative importance of environment. The technique is very simple, and amounts to comparing the offspring of high producing females with those of low producing females mated to the same sire. If heredity is strong, the difference between the two progeny groups will be large; if heredity is weak, the two progeny groups will be very similar. Of course, a correction must be made for the fact that one parent—the sire—is kept constant throughout, and the results must be averaged over large numbers of matings. The final figure measures the strength of hereditary influences and an estimate of the relative importance of non-hereditary, or environmental, effects is obtained by difference.

In the case of the fleece, such studies have only recently been made, and the story is only partly complete, even for the more important wool producing breeds. In New Zealand, the Romney has been subjected to the most intensive study. In this breed fibre fineness—expressed by the wool classer as the "count" of the wool—is fairly strongly inherited, especially when judgment is made at a particular region in the staple each season. Something like half the variation in an average mob of hoggets could be explained if the variations in count among their parents were known. The remaining fifty per cent. of the variation is largely due to non-hereditary influences which cannot be controlled by selection and culling. The non-hereditary fraction, of course, explains the well-known tendency for sheep to become appreciably finer or coarser in the wool on transfer from one locality to another. Wool character, which determines the price which a wool buyer is prepared to pay for clean wool of a given fineness, is about eighty-five per cent. dependent on these outside influences. Variation in fleece weight, which, after all, is what the wool cheque is calculated on, is about 90 per cent. environmental in origin. Although these estimates of environmental effects may appear high, it is important to note that they refer only to the range of effects encountered under conditions typical of well managed flocks. On much New Zealand sheep country, where hard conditions prevail during part of the year, still

more emphasis must be laid on non-hereditary effects.

Intensive Feeding Experiments:

It is clear from the figures just quoted that environmental influences affect the size of the wool cheque very materially. Of the many factors, which together make up what we understand by the term environment, feeding is easily the most important and surpasses all others in its effects. About two years ago, at Lincoln College, an experiment was designed to demonstrate, among other things, just how great these effects could be. In June of 1943, twelve Romney and twelve Corriedale ewes were selected from the College stud flocks, and divided into two closely matched groups. In the seven weeks before lambing was due to commence, half of each breed was fed in such a way that the average live weight of the ewes **increased** by about 18 per cent. The ewes remaining were fed poorly and made to **lose** about 14 per cent. of their initial live weight in the same period. After lambing, the two groups of sheep were kept at more or less constant high and low levels of feeding and shorn after six months. Crude fleece weights for these sheep included seven months' wool grown before the start of the trial when all the sheep were treated alike, yet the well fed sheep averaged fleeces weighing 13¼ lbs., while the average for the poorly fed sheep was only 7¼lbs. On a price basis, the difference would be greater still, because the wool of the well fed sheep was sound, while that of the poorly fed ewes showed a very marked break near the base of the staple.

For the twelve months from July, 1943, to July, 1944, the high plane ewes grew fleeces averaging 16.8 lbs. of greasy wool while the average production of the low plane ewes was only 5.4 lbs. **Under these extreme conditions, closely matched sheep changed their fleece production by 300 per cent.**

The progeny of the original ewes have been maintained on the same nutritional plan as their mothers, save that the lows were increased to approximately normal farm rates of growth. At 14 months, the highs clipped an average of 19.5 lbs. of wool while the "lows" averaged only 8.1 lbs.

Such big differences as this would only rarely occur in practice, but it is clear that much smaller differences in treatment would have had far-reaching results in terms of pounds, shillings and pence. Quite recently some Australian workers have shown that wool production is specially sensitive to changes in feeding when the sheep is on a bare maintenance ration. Just a little more food—enough to produce only a very slow rise in body weight—gives a disproportionate increase in wool growth.

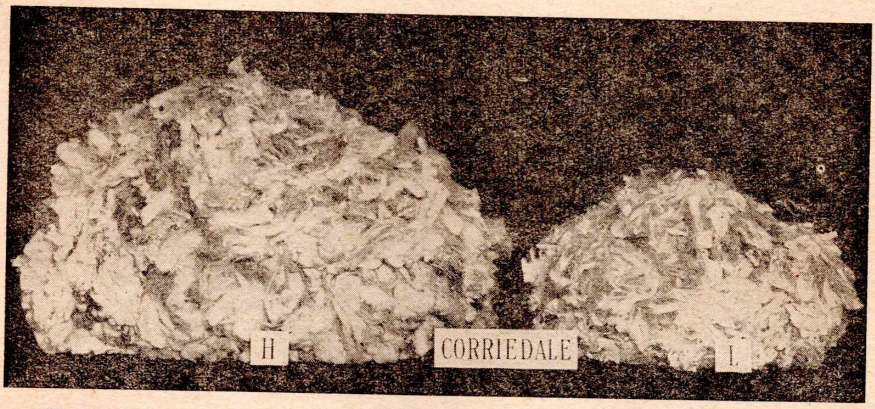
Every sheepman knows that winter is the time of the year when all these factors are likely to exert their maximum effects. In winter, pasture growth practically ceases, while to the normal maintenance requirement of the breeding ewe is added the increasing demand of the developing lamb. From about May or June until spring growth is well on the way, is a critical period for the wool cheque, the fat lamb returns, and for ewe mortality. It must be emphasised that during this period the fleece is merely an outward indication of inward factors which may greatly affect all the different features of sheep production. The "steaming up" process—building up reserves against the coming lactation—is probably just as important in ewes as it is in the dairy cow. The results show up in bigger lambs, maturing more rapidly, and having more profitable works-gradings. Pregnancy toxaemia, or twin lamb disease, too, may make big inroads into production and profits if sheep are allowed to lose condition just before lambing. In the experimental sheep at Lincoln, one poorly fed ewe of each breed was lost from this cause, despite the utmost care and attention. Increased use of greenfeed after sheep begin to die from this cause is often too late to save valuable animals, and is certainly too late to prevent a bad break developing in the fleece.

From the wool point of view, late lambing is to be recommended, for in this way, there is less danger of a critical period for the ewe coming too early for spring pasture growth. Here is the real difficulty in growing a first-class wool clip when early lambs, fat off the mothers, are required. Even in a fat lamb flock, however, it must be remembered that the advantages of early lambing may be offset by high mortality.

Wool Investigations on a Survey Scale:

Extensive observations over the past few years have established that breaks and tender wool constitute

High and low plane rams at 23 months. The rough appearance of the wool on neck and rump is due to covering. Fleece weight at 14 months: High 23.1lbs, low 7.7lbs.



Hogget fleeces from high and low plane Corriedale ewes. High 21.8lbs, low 7.7lbs.

the largest single source of loss to the wool grower. About one fleece in three, in our data, is recorded as having a slight break or worse. Fleeces graded as sound average eight per cent heavier than fleeces with various grades of breaks. If the lower value of these fleeces per pound is allowed for, it is easy to calculate that breaks cost New Zealand wool growers something like 1½ million pounds in revenue each season. Nearly all of this can be charged up to inadequate winter feeding, for evidence collected does not reveal any marked hereditary tendency towards the defect.

It cannot be too strongly emphasised that poor wool growth due to inadequate nutrition is almost invariably accompanied by other undesirable effects. These may be even more important than what happens to the fleece. Where broken and tender fleeces are a common occurrence, and on country where supplementary feeding is not practicable, quite large increases in efficiency of both wool and meat production have been achieved by reducing stocking, subdivision, and controlled grazing. To this should be added the advice to try lambing a little later, and where possible to shear early, since in this way the position of the weak region will be

changed from high in the staple to near skin level.

In addition to nutrition, mention must be made of the moisture relations of the fleece while on the sheep. Short dense wools like the Merino and some halfbreds hold the moisture in a rainy climate and allow the growth of colour producing micro-organisms which stain and rot the fleece. Long open wools blow up in the breeze and quickly dry out after a shower.

Finally, survey work has established real differences in efficiency among the various wool types found within any given breed. Using count as a landmark of type, and fleece weight as an index of efficiency in production, it has been found that where nutritional conditions are good stronger counts give much heavier fleeces than finer counts. This gain in weight is more than sufficient to compensate for a lower price per pound of wool. Where nutritional conditions are poor, on the other hand, fine fleeces are only a little lighter than coarse wool fleeces, and the extra price per pound easily over-rides the loss in weight. Moreover on hard conditions strong wool fleeces show much poorer character gradings and a definite tendency to become cotted. Since count is relatively strongly inherited, this knowledge can be put to use rapidly when buying rams and culling young ewes. Allowance should be made for changes in count due to age and sex.

It is not possible in a bulletin of this length to do more than draw attention to the very important part played by environment in wool production. This aspect has not yet been fully investigated and the work which is being done at the College is an attempt to lay a foundation on which a larger research programme will in due course be built. In the survey work, for example, more than 130,000 fleeces grown in about 40 different localities have been weighed and recorded in detail. Gradually the main types of sheep farming land in the Dominion are being covered, but progress has been seriously handicapped during the war. In the present season additional areas have been visited from Whangarei to the McKenzie basin. The College would be pleased to hear from any farmers desiring further details of the work, or who would like to co-operate in extending its scope.

Summary:

1. This bulletin sets out to stress the important part played by non-hereditary or environmental factors in wool production.

2. For economically important features like fleece weight the influence of heredity is weak, and, in general, special breeding methods are necessary for improvement in productivity.

3. Nutrition can change wool production by 300 to 400 per cent.

4. Special attention should be paid to provision of winter feed.

5. If winter feed is likely to be short, lamb a little later and shear as early as practicable.

6. Do not attempt to grow a type of wool unsuitable for the country.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.

ELLESMERE GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

Canterbury Mixed Cropping Farm Budget

Prepared by the Canterbury Agricultural College, Lincoln

Bulletin CHRISTCHURCH, FEBRUARY, 1946. No. 199.

INTRODUCTION—

A budget is an estimate of income and expenditure based on a pre-determined farming plan. Such estimates of farming operations are made for various purposes. The value to a farmer of being able to budget for himself lies largely in the fact that in order to do so successfully he must draw up a farming plan.

In this bulletin it is intended to give an example of a hypothetical mixed cropping farm budget for Canterbury, to help and encourage farmers to budget for themselves. **This budget, however, is merely by way of example and is purely hypothetical in every respect.** In a previous bulletin (No. 191) a dairy farm budget was outlined, and a further one on a sheep farm is yet to be issued.

DESCRIPTION OF LAND:

The land is a one hundred and forty acre block, suitable for small seeds and mixed cropping. Peas, wheat, barley, lucerne and certified pasture plants are grown. In this example the farm is considered to be suitably sub-divided, sheltered, drained and watered, and prices are taken on the basis of conservative standard values.

CAPITAL INVOLVED:

Land (bare) 140 acres at £31/10/- per ac., £4410; buildings (at valuation, not new but serviceable); house and garage, £800; implement shed and cow bail £120; whare £50; total for land and buildings £5380. This equals approximately £38 per acre for land and buildings.

LIVESTOCK:

125 4 & 5-year ewes at 20/-, £125; 3 S.D. rams at £3, £9; 3 dairy cows and 1 heifer at £7, £28; 1 ¾-draught horse, £10; pigs, £8; total £180.

IMPLEMENTS & TRACTOR:

At valuation, not new, but serviceable.

Tractor, £300; 2-furrow tractor plough, £30; set discs £20; grubber, £25; roller, £18; heavy tyne harrows, £10; spring cart, £10, and sundries £20; one half share of the following plant: drill £35, power mower, £30; binder, £18; header, £25; topdresser, £18; header, £350; sweep, £10; stacker, £20; total, £686.

SUMMARY:

Land and improvements, including buildings, £5380; livestock, £180; dead stock (implements and tractor) £686; total, £6246.

CROPS:

The first consideration is to determine the area of each crop to be grown and the sequence in which they will be grown. Such a sequence or rotation might be as follows:—

Fifteen acres old pasture followed by 15 acres of garden peas, followed by 15 acres of wheat, followed by 15 acres barley, followed by 5 acres of rape and grass and 10 acres of new autumn sown grass.

In any one year then, the "cover" on the farm would be: 15 acres peas (spring sown); 15 acres wheat (autumn sown); 15 acres barley (spring sown); 5 acres rape and grass (sown following spring); 10 acres new pasture (autumn sown); 15 acres one year pasture (grass seed); 15 acres two year pasture (clover seed); 15 acres three year pasture; 15 acres four year pasture; 10 acres old permanent grass; 5 acres lucerne; 5 acres buildings, plantations, fences, drains, and waste, etc.; total, 140 acres.

STOCK:

Given the above "picture" of the farm, the stock policy must next be considered. The number of ewes wintered depends on the feed available.

(a) Winter Feed:

Grazing. New grass, 5 acres rape and grass, 10 acres new pasture, (autumn sown), light grazing, if any; other pasture, 70 acres (assuming that pasture is ploughed for peas about July.)

Hay:

Lucerne. Five acres at 4 tons per acre equals 20 tons: allowing 5 tons for the horse and cattle 15 tons are available for winter feed for sheep and for sale. Grazing available is 70 acres of established pasture and a picking from 15 acres of new grass all on good land. This together with say 6 tons of hay would be ample for wintering the flock. This leaves 9 tons for sale.

(b) Spring & Summer Feed and Small Seeds production:

It is common practice to save one year pasture for grass seed, and in suitable subsequent years to shut up the second year pasture for clover seed. If this practice is adopted in this example, then approximately 30 acres of pasture will be closed up from September or October to January, and the main grazing available for this period is forty acres of old pasture. During this time the pasture should carry all the ewes and lambs and dairy cattle.

THE BUDGET:

Now that the general farm management programme has been decided upon, it is possible to draw up an estimate of how the plan would work out financially. It is the supporting details to a budget, however, which are important and following this budget each item will be fully explained. It is in these explanations that many of the finer points of management will be revealed and, it is hoped, much that will aid the farmer in working out his own figures. **It must be remembered that all figures are hypothetical.**

Estimated Income:

Lambs £156; cull ewes £40; wool £60; wheat £192; barley £186; peas £234; grass seed £188; white clover £180; butter-fat, pigs and calves, £55; lucerne hay £31; total £1322.

Estimated Expenditure:

Stock purchases £87; fertiliser £18; lime £26; seeds £75; dressing and certification charges £24; loss on sacks and wool packs £6; twine £2; freight and cartage £23; fuel, oil and repairs for tractor £75; car (farm use) £34; accountancy and legal £10; repairs and maintenance £44; phone and mail £8; general and sundries £26. Wages: Casual labour £18; stacking hay £10; shearing, crutching and dipping £6; keep for workers £4; wages of management £325. Overhead: Rates £34; land tax £11; insurance £9; depreciation £101. Interest: Live and dead stock £43; farm £243. Surplus, £60. Total, £1322.

SUPPORTING DETAILS:

Each item in the budget will now be fully explained, and enlarged upon.

Estimated Income:

Lambs: 103 per cent. lambing, 3 per cent. loss from tailing to sale, 125 ewes to rams, therefore 125 lambs at 25/- each. £156.

Cull Ewes: Half the flock less deaths is sold each year. 58 ewes at 14/-, £40.

Wool: The whole flock less a few deaths, plus rams, are shorn, and should clip on average 8½lbs of wool inclusive of crutchings. 120 fleeces at 10/- each, £60.

Wheat: 15 acres at 40 bushels per acre equals 600 bushels milling wheat, less seed 30 bushels; for sale, 570 bushels at 7/1 per bushel, less f.o.b. charges, etc., at 4d per bushel, equals 6/9 nett "on trucks." £192.

Barley: 15 acres at 45 bushels per acre firsts equals 675 bushels at 5/6 per bushel. £186.

Peas: (Garden) 15 acres at 25 bushels per acre firsts equals 375 bushels at 12/6 per bushel. £234.

Grass Seed: (Certified Perennial Ryegrass), 15 acres at 25 bushels machine dressed seed per acre equals 375 bushels at 10/- per bushel. £188.

Clover: (Certified white), 15 acres at 80lbs machine dressed seed per acre equals 1200lbs at 3/-. £180.

Butter-fat: (For dairy farm budget see Bulletin No. 191). Three cows in milk less produce from one for household; butter-fat, pigs and calves. £55.

Lucerne Hay: Nine tons at £3/10/- per ton in stack. £31.

Estimated Expenditure:

Stock Purchases—

Ewes: Half the flock plus allowance for a 5 per cent. death rate, are purchased each year. 64 4 and 5-year ewes at £1/5/- "on the farm" (ewes 24/-, plus railage 1/-). £80.

Rams: £6.

Cows: Replacements bred on farm.

Horses: One horse, depreciated at 10 per cent. per annum. £1.

Total stock purchases: £87.

Fertilizer, Lime and Seeds:

Fifteen acres wheat: Own seed, 15cwt. super.

Fifteen acres barley: 2 bushels per acre=30 bushels at 7/3 equals £10 17/6. 15cwt. super.

Fifteen acres peas: 4⅓ bushels per acre, bushels at 12/6, £42. Super, 15cwt, lime 15cwt.

Ten acres new pasture: 1 bushel cert. per. rye at 20/- 2lbs. cert. white clover at 5/-, £15. Super 10cwt.

Five acres rape and grass: 1 bus. cert. per. rye at 20/-. 2lbs cert. white clover at 5/-, 1½lbs rape at 1/-, £7/17/6. Super 5cwt., lime 5 cwt.

Total cost of seed: £75.

Topdressing:

Five acres lucerne (2cwt. super and ½ ton lime per acre), 5cwt. super and 50cwt. lime.

Fifteen acres young grass (1 ton lime per acre), 300cwt.

Fifteen acres other pasture (½ ton lime per acre), 150cwt.

Totals: Super, 70cwt.; lime, 26 tons.

*Total Super: 3½ tons delivered on farm, £5 per ton, £18. Super, £4 11/- per ton. Railage, 5/- per ton (20 miles in small lots). Cartage, 4/- per ton (4 miles). Total, £5 per ton.

Total Lime: 26 tons delivered on farm at £1 per ton, £26. Lime, 16/- per ton. Railage free for 100 miles. Cartage, 4/- per ton. Total, £1 per ton.

*Dressing and Certification Charges, etc: Dressing—Ryegrass, 470 bus. F.D. at 6d equals £12; white clover, 1800lbs F.D. at 1d equals £7/10/-. Receiving, weighing, etc., at 4/6 per ton, £1. Certification—30 acres at 1/- per acre entry fee, £1/10/-. Sealing, etc., at 1½d per 20lbs, £3. Total, £24.

Loss on sacks and wool packs: 570 bushels wheat and 375 bushels peas, at 3⅓ bushels per sack, 283; 675 bushels barley at 4 bushels per sack, 169; 470 bushels F.D. ryegrass at 5 bushels per sack, 94; 1800lbs F.D. white clover at 200lbs in double sacks, 18. Total sacks, 564. Loss on 564 sacks at 2d equals £5.

Woolpacks: 125 fleeces at 40 fleeces per pack equals 3 at 7/-, £1; loss on sacks and woolpacks, £6.

*470 sacks wheat, barley, peas and white clover, at 5½d per sack, £10/15/-; 94 sacks ryegrass at 3¾d per sack, £1/9/-; 3 bales of wool at 1/9 per bale, 6/-; others at 1/6 per ton mile—say £5/10/-; freight on sundry purchases—say £5. Total freight and cartage, £23.

Motor Car (for farm purposes): Say one trip to local village per week and one trip to Christchurch per fortnight, at 6d per mile, £34.

Accountancy and Legal: Includes the cost of preparing social and national security and income tax returns, return of land, and other legal expenses, £10.

Repairs and Maintenance (all repairs on average annual value): Buildings—house, whare and garage, 1½ per cent of £850, £13; implement shed and cowbail, 2 per cent of £120, £3. Plant and machinery—Implements, 5 per cent of £386, £20; tractor (see under fuel and oil); fencing—say 210 chains at 9d per chain for materials, £8. Total repairs and maintenance, £44.

Telephone and mail—say £8.

General and sundries, £26.

Casual Labour: One man for 4 weeks, £18. Stacking, 4 cuts (20 tons) lucerne hay, £10.

Shearing, Crutching and Dipping: Shearing—by contract in neighbour's shed at £2/10/- per 100, £4; crutching—by contract in neighbour's shed at 8/- per 100, 10/-; dipping—in neighbour's dip at 2½d per head, £1/10/-. Total for shearing, crutching and dipping, £6.

Keep for Workers: 1 man for 4 weeks, at £1 per week, £4.

Wages of Management: On a farm of this size it is generally considered that the reward to a working owner with a wife and three young children would be in the vicinity of £325, without allowing for payment of life insurance, social security and income taxes.

Overhead: Rates—say 1½d per £1 capital value of £5380, £34.

Land Tax—1d per £1 unimproved value of say £2640 (assuming farm not mortgaged), £11; insurance—employer's liability and personal risk, £5; buildings—value £970, at 8/8 per £100, £4. Total insurance, £9.

Depreciation: Wood and iron buildings, £970 at 2½ per cent, £24; implements, £386 at 10 per cent, £39; tractor, £300 at 12½ per cent, £38. Total depreciation, £101.

Interest: Live and dead stock, £866 at 5 per cent, £43; farm, £5380 at 4½ per cent, £243.

CONCLUSION:

Farmers should bear in mind that while this budget is a complete forecast of the management envisaged on a hypothetical Canterbury mixed cropping farm, it is not suggested that the farming policy herein described should be literally followed. It is intended that farmers will be helped in budgeting by using this as a basis or example.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.

KILLEARN GUARDIAN

CANTERBURY CHAMBER OF COMMERCE
AGRICULTURAL BULLETIN

Educational Courses at Canterbury Agricultural College

Prepared by the Canterbury Agricultural College, Lincoln

Bulletin CHRISTCHURCH, MARCH, 1946. No. 200

INTRODUCTION:

In this, the two-hundredth Bulletin, a brief summary of the various educational courses available at Canterbury Agricultural College is given, together with a list and index of Bulletins Nos. 151-200.

Apart from research, pure seed and stock promulgation work, the main job of the College is that of education. These bulletins, issued in conjunction with the Canterbury Chamber of Commerce, are designed to make available research results and facts that may assist in the fuller development of the primary industry. A deeper appreciation of rural life and sounder development of agriculture generally can be expected in countries where the educational standard is relatively high. This bulletin informs the reader of the various educational courses available.

COURSES OF INSTRUCTION:

The College offers the following courses, all of which are available to returned servicemen.

Liberal provision to enable such servicemen to undertake training is made by the Rehabilitation Board. Tuition and boarding fees, together with a living allowance are paid by the Board for approved trainees. Men contemplating the taking of any of the courses outlined should communicate with their local Rehabilitation Officer or local Vocational Guidance Officer.

Men who have not qualified in the University Entrance examination and who wish to take a degree course may be granted provisional matriculation by the University of New Zealand.

1. Course for Degrees of Agricultural Science (B.Agr.Sc. & M. Agr.Sc.)

The course is available to those who have completed the University Entrance examination and who aspire to professional appointments such as teachers, research workers and field instructors.

The training for the Degree of Bachelor of Agricultural Science lasts for four years, the first of which is taken at one of the University Colleges at Auckland, Wellington or Christchurch, or at the University of Otago.

The Degree of Master of Agricultural Science takes a further year. (Degree students are in residence for approximately thirty weeks each year).

Degree course students are assisted to obtain paid work on approved farms during their long vacation in order to obtain additional practical experience and to help pay College fees.

2. Course for the Diploma of Agriculture (Dip.C.A.C.).

This course is available to male persons of 17 years of age and over. It provides a sound practical and theoretical training in all phases of agricultural and pastoral production to students who intend to become farmers. It lasts for two years. Previous practical farming experience is desirable though not essential.

During the training in practical work every student takes part in the growing and handling of all classes of cereal and fodder crops, the management of a dairy herd and handling of young stock, the management of stud sheep and a cross-bred flock for raising fat lambs, and the management of a modern 2000-bird poultry unit. He is also taught to operate every implement, machine, and power unit that is likely to be found on any farm, so that he is equipped to become a cereal farmer, dairy farmer, stud stock breeder, or sheep farmer. The College is able to offer unequalled facilities for a general training in every branch of farming.

Technical work includes engineering practice, surveying and levelling, building construction, wool-classing, and blacksmithing.

3 Course for the Diploma of Valuation and Farm Management (Dip.,V.F.M.).

This course is an advanced and specialised one open only to those who have taken one of the above courses or who possess training and experience of substantially equivalent value. It is specially planned to provide a sound training in the business aspects of agriculture and is of great value to young men who will be managing farms or who will be seeking positions in the various Government Departments which are concerned with rural activities—Fields Division of Department of Agriculture, Valuation Department, Rural Finance Corporation, Native Department, Lands and Survey Department, Public Trust Office, and State Advances Corporation. Men entering commercial firms and lending institutions or becoming professional valuers should find it particularly useful.

The course is of one year's duration. University graduates in Agricultural Science will receive credit for those subjects which are common to the two courses. Other students will be required to complete a full year's study. Particular attention is devoted to the subject of "Farm Management," which, in addition to the subject matter outlined in the same subject for the Degree course will include an intensive course of instruction in farm surveys and valuations, the analysis of farming practices, the planning of farming operations, preparation of budgets, reports, farm management supervision and general advisory and regulatory work in connexion with rural production.

4. Short Courses.

Various short courses are offered from time to time. Each is of a few weeks' duration and is more or less specialised, having relations to one aspect of farming, e.g., grassland, sheep management, cropping, and animal diseases.

The courses are designed to assist young farmers and others who are unable to take a full course. By attending at least one special course each year, the young farmer can, in time, build up a very sound and useful knowledge of many aspects of the industry.

Dates and other details of short courses are advertised in advance in the daily press, and information regarding them can be had on application to the College.

In addition there are the following special courses designed to cater for, but not necessarily limited to returned servicemen.

5. Intensive General Course.

An intensive course of eight months; March-October, devoted entirely to lectures, demonstrations, consideration of systems of farm management and to farm inspections for men, with approved practical farming experience and not under 20 years of age. In general not less than five years' diversified farming experience will be required before students are eligible for admission to this course. The instruction in this course follows closely that given in 2, but practical work is omitted. This course is of special value to men undertaking farming and it is also recognised as a pre-requisite for Course 3.

6. Short Course.

An intensive course of twelve weeks to be offered twice a year commencing March 1 and September 1 (additional courses may be offered as found necessary). This course is adapted to the needs of men who will undertake practical farming and already have some experience of farm work. Instruction covers arable, sheep and beef cattle, and dairy farming. Particular attention is given to farm management.

7. Horticultural Courses.

A. With the progressive development of the Dominion, horticultural pursuits should assume increasing importance. To meet the needs of men training for careers as commercial nurserymen, tomato growers, orchardists and berry fruit growers, curators of public gardens and reserves, vegetable and flower growers, or officers of the Horticultural Division of the Department of Agriculture, a general course of training extending over two years is offered.

No special entrance qualification is required but it is advisable that students should have had at least two years' secondary education. The minimum age for entry is seventeen years. It is an advantage, though not essential, for students to have had some previous practical experience in horticulture.

This course will commence in January each year. Lectures begin about March 1st and conclude early

in December. Those students who wish to sit for the examinations of the Royal N.Z. Institute of Horticulture may carry on with their practical training during the vacation, either at the College or at some approved garden.

B. An intensive course of 12 weeks' duration is also offered. It is designed specially for students who have had previous practical experience in horticulture. From one to three of these courses will be offered annually as required.

8. Poultry Farming Course.

A course of sixteen weeks' duration in poultry farming is offered annually commencing on August 1st. The syllabus covers poultry farm management, breeding of stock, provision of feeds, control of disease.

9. Wool-classing Course.

A general wool-classing course of three months is available twice a year, or more frequently if necessary. A certificate will not be issued until after the trainee has completed one full season's approved experience of classing or sorting in shearing sheds, wool store or wool scouring works. Trainees who have qualified in the general course and have had at least one season's additional practical experience are eligible for an advanced course of three months. The syllabus is based on the foregoing but is more advanced in character. Wool-classing certificates are also available to degree and diploma course students who attain the required standard and who have completed an approved amount of practical work.

Qualifications required for admission to the various courses, details of prescription and fees, are available on application to the Registrar, Canterbury Agricultural College, Private Bag, Christchurch, or from a perusal of the College Calendar. Details of scholarships and bursaries available are also set out in the calendar. Most of the courses begin in the period January to March.

A copy of the calendar is available on application.

Copies of this Bulletin may be obtained from the Secretary, Canterbury Chamber of Commerce, P.O. Box 187, Christchurch.